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STATE OF VERMONT AGENCY OF ENVIRONMENTAL CONSERVATION. SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY PLAN

Vermont State Agency of Environmental Conservation

Prepared for:

Resource Planning Associates, Incorporated
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January 1973

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STATE OF VERMONT
AGENCY OF ENVIRONMENTAL CONSERVATION

Re: RA-73-6

SOLID WASTE MANAGEMENT and RESOURCE RECOVERY PLAN

COLOR ILLUSTRATIONS REPRODUCED
IN BLACK AND WHITE

Prepared by
Resource Planning Associates, Inc.
Cambridge, Massachusetts, 02138

January 1973

III

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FOREWORD

Vermont has chosen a distinctive approach to solid waste management. Act No. 252 of the Acts of 1971 made very clear that recycling is more than a possible alternative; it is a positive goal in managing Vermont's solid waste needs. Twenty-four VSA §2205 directs the Secretary of Environmental Conservation to "develop a state plan for the establishment and operation of solid waste recycling throughout the state." Given this explicit directive, the consultants' task was not to consider the feasibility of resource recovery as an alternative, but to develop the most practical and least costly resource recovery plan consistent with the special needs of Vermont.

The physical, economic, and political diversities of Vermont demanded a regional approach. The statewide Solid Waste Management-Resource Recovery Plan is intended to be a working document, capable of providing for centralized direction where it is essential, yet accommodating local particularities to the fullest extent possible. For example, the city of Rutland, which is running out of landfill space, can seek a short-term solution to its special problem without jeopardizing the success of resource recovery in the entire region.

The study began in September, 1972, and had to be completed in time for consideration by the General Assembly on January 15, 1973. In view of this time constraint, the consultants chose to allocate their time among what they considered to be the four major priorities:

- formulation of a policy document which would serve as a guide throughout the implementation period of the Plan
- development of a statewide approach which would allow maximum consideration of regional needs
- concentration upon an analysis of the *municipal* waste stream, which accounts for virtually all of Vermont's wastes currently disposed of on land
- development of rates of waste composition, generation and seasonal variation specific to Vermont. (Analysis revealed that national averages could *not* be applied with any accuracy to the special case of Vermont.)

The consultants sought to prepare a document that could be understood by all Vermonters, lay readers as well as specialists. The text is therefore free of the extensive computations, economic analysis and methodological framework that were an integral part of the study. The technical aspects are, however, outlined in the appendices. Chapter Two, "Background Information," is intended to provide a general description of the major characteristics of the State of Vermont which were considered by the consultants in their decision making process. Throughout this chapter, bibliographical references allow anyone interested to obtain more detailed information.

RESOURCE PLANNING ASSOCIATES, INC.

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ABSTRACT

1. Findings

The primary method of disposing of solid waste in Vermont is by using land. There is no organized system, but rather a number of uncoordinated systems involving both the private and public sector. Current methods of handling solid waste in Vermont will be inadequate to fulfill the State's future needs.

2. Needs for a System

Population growth will result in an increase of over 50 percent of the municipal waste stream — from the current level of 313,000 tons per year to 474,000 tons per year in 1980. The waste generation rate per capita per day will increase from 3.8 pounds in 1970 to 5.3 pounds in 1980. Out of the 116 sites currently being used for disposal, only a dozen meet sanitary landfill standards. Seventy-four percent of Vermont's population is not served by *sanitary* landfills. Furthermore, the existing disposal sites have a capacity of only 15 years at present per capita rates of generation. If the current system is continued, the average price paid by the private individual for disposal of his refuse will double by 1975. Finally, the Acts of 1971 (Adjourned Session 1972) mandate the establishment and operation of a statewide solid waste management and recycling system.

3. Problems

- A dispersed, low density population is the single most important factor affecting solid waste management in Vermont. Transients generate 15 percent of total municipal waste, and the burden of this significant amount of waste falls heavily on small towns.
- Presently over 190,000 tons of marketable materials with an economic value of $2.5 million are buried in landfills.
- The existing collection and disposal system requires substantial public investment to make it acceptable in terms of current standards.

4. Recommendations

Recommendations are formulated in terms of minimizing the burden on land through effective resource recovery as well as by optimum use of present landfills. The Solid Waste Management-Resource Recovery Plan will: (1) initiate material recovery through mandatory domestic, commercial and industrial source separation and simple processing in regional treatment facilities; (2) consolidate the existing disposal sites into regional sanitary landfills to gain economies of scale; (3) establish regional transfer stations to provide convenient disposal sites to all citizens in the State. In order to guarantee a consistent source of supply to treatment plants, facilitate operation of the entire system, and minimize the cost increases associated with handling segregated waste, statewide organized collection services are recommended. Locations of these disposal sites (regional sanitary landfills, treatment facilities or transfer stations) would be planned so that no person in the State would have to drive more than 12 miles to dispose of his refuse. The private individual or collector will bring his segregated waste to the most convenient site. To achieve reduction of the waste stream beyond the level reached by mandatory source separation, the Plan recommends both source reduction and additional processing such as methane production, composting and incineration.

To manage the overall system a single State entity should be created. However, operating control and maintenance should remain at the local level. The State would only assume the capital risks associated with the development of the recommended system and monitor and enforce standards for sanitary landfills, collection and resource recovery.

Rather than traditional funding mechanisms, the Plan proposes that a solid waste management fee of $3 per $1000 (3 mills) be placed on all products sold at the retail level. This fee would generate more than $2 million per year — enough to implement the Plan and defray additional collection costs at the local level. The entire solid waste management-resource recovery system could be financed by this solid waste management fee. In conjunction with the management and financial program it is recommended that enforcement of the "bottle ban" be delayed three years.

The capital expenditure program is based on a step by step approach. The implementation of the collection, disposal and resource recovery system is phased over the next seven years. It is recommended that the first increment of this system be established and operated in the Northwest region of the State and serve as a pilot for the remaining portion.

5. Major Advantages of the Proposed System

- Achieves the maximum practical level of recycling for a state of only 440,000 inhabitants.
- Minimizes the use of land for disposal of municipal solid wastes.
- Gives 100 percent of the population access to a sanitary means of disposal.
- Maintains maximum managerial and technological flexibility to accommodate future developments.
- Achieves economies of scale wherever possible in development, operations and administrative services.
- Maximizes the involvement of the private sector yet incorporates the benefits of public participation.
- Maximizes the local control without creating conflicting local jurisdictions.
- Resource recovery and collection-disposal portions of the plan are independent. Thus, one portion is not dependent upon the other for success.
- Implementation of resource recovery will not be jeopardized by the legislature's ultimate decision on the "bottle bill". Although active enforcement of the bottle ban would have adverse effects, they would not be fatal to this aspect of the plan.
- Costs no more than the present disposal operation upgraded to meet current standards and in addition, incorporates a recycling effort mandated by the legislature.

I. SOLID WASTE MANAGEMENT — RESOURCE RECOVERY PLAN

A. OBJECTIVES AND FUTURE NEEDS

Outline of Section A

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Current methods of handling solid waste in Vermont will be inadequate to fulfill the State's future needs. Prohibiting disposal of wastes into water and air has simply shifted the entire burden of solid waste disposal to the land. But existing landfill sites have a capacity of only 15 years at present per capita rates of generation and establishment of additional disposal sites is made extremely difficult by severe soil limitations. Effective resource recovery could remove much of the burden from the land, but present recovery from the waste stream is less than one percent. Thus, any plan developed for handling Vermont's future solid waste needs must be formulated in terms of minimizing the burden on the land, through effective resource recovery, as well as optimum use of present landfills.

1. Summary of Objectives

The Solid Waste Management — Resource Recovery Plan was designed to define for Vermont a solid waste management system, organization, financing and implementation program which would:

- achieve the maximum practical level of recycling;
- minimize the use of land for disposal of municipal solid wastes (the "zero landfill concept");
- give 100 percent of the population access to a sanitary means of disposal;
- maintain maximum managerial and technological flexibility to accommodate future developments; and
- minimize cost to the State's inhabitants.

Table 1 outlines the current situation in storage-collection, disposal and resource recovery, and the goals of the Solid Waste Management-Resource Recovery Plan in each of these activities. For descriptive and analytical purposes the categories of *storage-collection*, *disposal* and *resource recovery* will be used throughout the report. (Other categories, e.g., transfer, processing, could well have been used; all categories were consolidated into these three in the interest of maximum readability for the layman.)

2. Current State Policies

There is presently no formal state policy for *storage and collection*.

Most of the State policy related to *disposal* is contained in Subchapter 8 (rubbish and garbage) and Subchapter 10 (junkyards) of 24 VSA-1972. Subchapter 8 requires each town or city to provide for sanitary disposal of garbage and refuse, subject to the regulations established by the Board of Health (Vermont Health Regulation Chapter 11). Each disposal site must be approved by the Environmental Protection Division of the Agency of Environmental Conservation (AEC). The penalty for throwing, depositing and dumping refuse may be up to $500.00 and/or 10 days imprisonment or up to 40 hours of work collecting trash or litter from roadsides or other public property.

Twenty-four VSA-1972, Subchapter 8, 2204 provides for *resource recovery*. It requires that the "secretary of environmental conservation......develop a state plan for the establishment and operation of solid waste recycling centers sufficient to meet the need for solid waste recycling throughout the State."

3. Current Problems and Future Needs[1]

Resource Planning Associates' review and analysis of current practices of solid waste management in Vermont revealed several critical variables that will determine the contours of any proposed system. Some of these factors are related generally to solid waste management, others are unique to Vermont.

Vermont's population is expected to grow by 15 percent from 440,000 to nearly 500,000 inhabitants over this decade. At the same time, the waste generation rate[2] per capita and per day will increase by 37 percent, from 3.8 pounds in 1970 to 5.30 pounds in 1980. This will result in an increase of over 50 percent in the waste stream — from the current level of 313,000 tons

TABLE I

SUMMARY OF CURRENT SITUATION AND GOALS

Activities	Current Situation	Goals
STORAGE - COLLECTION	• 50% directly delivered by residents • 50% picked up by organized collection services	• 0-20% directly delivered to landfills by residents • 80-100% picked up by organized collection services
DISPOSAL	• 53 "approved" landfills (60% substandard) • 63 open dumps • 20% of population not served by "approved" landfills • 75% of population not served by "sanitary" landfills	• consolidation of disposal sites into regional sanitary landfills • 100% of population served by sanitary landfills
RESOURCE RECOVERY	• mainly voluntary — less than 1% (by weight) recovery of waste stream	• 40% (by weight) recovery through existing markets, simple processing, and public participation • additional reduction (up to 60%) through other processing methods, e.g., composting, methane production, source reduction, etc.

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[1] See *infra*, page 53 and page 76.

[2] Including waste generated by tourists.

per year to 474,000 tons per year in 1980. The present collection and disposal systems will be unable to absorb this significant increase.

More than 1,300 acres of land — 53 "approved" landfills and 63 open dumps — are currently being used for disposal. Eighty percent of the existing "approved" landfills do not meet the sanitary landfill guidelines to be promulgated by the United States Environmental Protection Agency (EPA). This is because the Environmental Protection Division of AEC[3] lacks personnel, has been unable to evaluate carefully each site according to national standards, and therefore is reluctant to enforce standards strictly at this stage.

Nearly 100,000 people are presently not served by an "approved" landfill and approximately 325,000 inhabitants are not served by *sanitary* landfills. If land continues to be used for disposal, a substantial public investment in the present system is needed to make it acceptable in terms of current EPA and State standards. The average price paid by the private individual for disposal of his refuse on land will double by 1975.

The increasing waste stream, the inefficiency of collection and disposal systems, the need for significant capital expenditures and rising costs do not distinguish Vermont's solid waste management problems from those of other states in the nation. There are, however, several characteristics which are peculiar to Vermont alone.

Population distribution is the single most important factor affecting solid waste management in Vermont. Some urban areas such as Burlington and Rutland have population densities of over 250 people per square mile, while certain areas in Essex County and others have less than 1 person per square mile. Over 60 percent of the State is classified as rural. Tourism is the second most important factor. Over 6 million people visited Vermont in 1971–1972 and generated 15 percent of the total waste. Significant involvement of the private sector in the present collection and disposal system is another outstanding feature of the State's present system.

The complex jurisdictional structure of Vermont (more than 250 entities with solid waste management authority or responsibility) is an obstacle to "regional" management of the solid waste problem. An increasingly important consideration is that certain regions in Vermont will soon be running out of inexpensive methods for disposal on land.

4. Vermont and the Nation

Over the past three years, Vermonters have dramatically expressed their desire to preserve the quality of their environment. In 1970, the State's development control law, Act 250, was passed (*infra*, page 23). This Act embodied a strong preference for preserving Vermont's rural character and natural resources rather than encouraging "progress" at the expense of the environment. In 1972, as a measure to prevent littering, a tax on all non-returnable beverage containers became effective (*infra*, page 46). The same legislation requires the establishment of a statewide solid waste resource recovery system (*supra*, page 1).

Vermont is not alone in its efforts to recover rather than bury resources within the waste stream. States and municipalities throughout the nation are becoming increasingly involved in recycling and energy recovery. Examples are the $12.8 million solid waste recovery plant in Wilmington, Delaware, which will handle 485 tons of domestic solid waste per day, and the plant being built in Baltimore, Maryland, which will convert 1,000 tons per day of the city's solid waste into fuel gas. In both cases, ferrous metals and crushed glass will be recovered from the waste stream. In Franklin, Ohio, a demonstration plant reclaims small quantities of paper, fiber, metals and glass.[4] A $13.7 million conversion complex is planned for Nashville, Tennessee. It will incinerate approximately 720 tons of solid waste daily and convert the resultant energy to steam, providing central heating and air conditioning to 24 office buildings. There are many other such concrete examples of attempts to recover resources from the waste stream.[5]

These systems are designed for heavily urban areas, and are not suited to Vermont's needs. However, this does not preclude the possibility of a rural state, efficiently recovering materials from its municipal waste stream. The legislative developments of the past three years are convincing evidence that the citizens of Vermont have accepted this challenge to their environment. Rejecting the proposition that resource recovery is an alternative reserved to rich and densely populated areas, Vermont has adopted it as a viable and positive answer to its problems of solid waste management at the state level. This is a unique feature of Vermont's approach to solid waste management. No state in the nation has yet established a statewide resource recovery system.[6] Vermont will be a pioneer.

Reliance on public participation is a second original feature of Vermont's approach. Success will be dependent upon the willingness of the people of Vermont to separate their refuse into three basic components — paper, containers and other wastes. The degree to which individual Vermonters will separate materials in response to legislative command or public enthusiasm is uncertain. But this, too, is part of being a pioneer State.

Although regional sanitary landfills as a disposal alternative are not an original aspect of Vermont's Plan,[7] they will be critical to successful implementation of the overall plan. Regional organization of sanitary landfills furthers minimum use of land for disposal thus conserving one of the State's most valuable natural resources.

B. CATEGORIES OF SOLID WASTE MANAGEMENT

Outline of Section B

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3. Resource Recovery	3
• Material Recovery	3
• Energy Recovery	3
• Marketing	3

An understanding of solid waste management requires an analysis of three basic categories: (1) storage-collection, (2) disposal and (3) resources recovery. This section presents the critical technological and economic factors associated with each of these three activities and relates them to the current situation in Vermont.

1. Storage — Collection

Storage refers to the techniques and regulations governing the storage of waste at the source of generation. Inadequate storage facilities may result in exposed garbage, littering, and burning practices and may be detrimental to public health (air pollution, rodent and insect infestation). There is little control of on-site storage practices in Vermont (*infra*, page 41).

Collection involves moving the refuse from the source of generation (household, retail stores, factory, etc.) to the disposal site.[8] This activity can be undertaken individually by households, retail stores, etc. or collectively by municipal or private organized collection services. In Vermont the charges involved vary according to system and area and average $20 per ton collected.[9] Although this figure seems high as compared to the national average ($13 per ton collected), closer analysis reveals that the total amount spent on collection divided by the total tonnage of waste brought to the landfill is almost identical to the national figure. This is because approximately 50 percent of the population bring their own trash to the landfill site (*infra*, page 40). As a result, economies of scale in collection are reduced and the "imputed costs" of individual collection are not reflected in total cost figures.[10]

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[3] AEC is the Agency of Environmental Conservation for the State of Vermont. See *infra*, page 51 for a detailed description.

[4] The capacity of the plant (using the Black Clawson system) is 150 tons per 8 hour day. Capital cost is $1.775 million (excluding mechanized glass sorting system).

[5] Simple product recycling is also becoming more common. Twenty two U.S. cities including Chicago, Atlanta, Houston, Tampa, and Oakland use magnetic systems to reclaim steel cans from municipal refuse. The City of Madison, Wisconsin, started collection of segregated newsprint as early as September 1968. Member companies of the Glass Containers Manufacturers Institute operate approximately 100 reclamation centers in 25 states.

[6] There is at present no operational statewide resource recovery system in the United States. New York, which has just authorized $175 million for the construction of recycling facilities, and Connecticut are two outstanding examples of states at the planning stage.

[7] Throughout the nation, shortage of land and jurisdictional disputes lend increasing impetus to development of regional and multi-jurisdictional programs for waste management. According to the Third Annual Report of the Council for Environmental Quality, released August 1972, 31 states plus the District of Columbia and Guam had completed comprehensive solid waste management plans by June 1972 under the provisions of Section 206(a) of the Solid Waste Disposal Act of 1965, while 17 states and territories had plans in the drafting stage.

[8] It may be direct (i.e., from the home to the landfill) or indirect (i.e., from the home to an incinerator and finally to the landfill).

2. Disposal

Disposal is the final step of any solid waste management system. Nearly one hundred percent of the waste generated in Vermont is disposed on land. The technology and economics involved vary with a dump, "covered" landfill, or sanitary landfill. According to EPA proposed disposal guidelines, the sanitary landfill is the only permissible method of land disposal. A sanitary landfill requires specific soil and location, daily compaction and cover of the refuse with a layer of earth and no danger whatsoever to the land itself or the surrounding environment.

Although 53 landfills in Vermont are "approved," 80 percent of them are below current sanitary landfill standards (*infra*, page 41). Operating and capital costs vary greatly according to size, method of operation and location of the sanitary landfill. The operating cost per ton of a well-located, with on-site cover material, average size sanitary landfill in Vermont would range from $2.50 to $7.00 per ton. However, this cost may go up to $15.00 and $20.00 per ton in areas with inadequate soil composition or land which requires special site preparation.

To limit the quantity of waste to be disposed, several waste reduction processes, including pulverizing, shredding, composting, source reduction are currently utilized. Their operating costs vary with the technology involved and range from $2.50 to $15.00 per ton.

3. Resource Recovery

Resource recovery is also a method of waste reduction. It is so important that it will be considered in a separate category of solid waste management. Resource recovery methods are aimed at recovering materials or energy or both from solid wastes.

Material recovery is the activity of separating, reprocessing and marketing the materials within the waste stream. Separating and reprocessing can be achieved through sophisticated techniques in large automated plants or with simple mechanical or manual processes. In the area of fully automated systems using mixed waste as input, only prototype plants have been built. Many technological problems still exist in both design and implementation.

The initial problems associated with large recycling plants include: significant initial capital investment (several million dollars per plant), high operating costs (between $10.00 and $30.00 per ton), requirement of a large throughput of waste (in the 500 tons per day range, i.e., serving a population of 200,000). The systems currently operational achieve very little materials recovery (less than 7 percent of input tonnage).

Simple mechanical processes exist to retrieve steel cans from mixed refuse using magnetic separation. However, no simple system, other than handpicking, is yet available to segregate paper or glass from mixed refuse. Important savings in capital expenditures and operating costs may be achieved if the materials are separated by hand at the source of generation. In addition, separation at the source permits recovery of more materials and yields a higher quality "output" than any system currently on the market.

Energy recovery is the processing of mixed waste and the marketing of the energy generated. Energy recovery is a by-product of a destructive process, usually incineration or pyrolysis. Energy recovery technology includes systems designed to recover steam directly for resale and systems aimed at electric generation. Both systems require an extensive distribution network — pipes if steam is generated, and cables for electricity. No optimum system has evolved from a cost effectiveness point of view. Energy recovery requires extremely high capital expenditures (several million dollars) and is only viable in specific areas (large urban centers).

An integral part of any resource recovery system is the *marketing* of the resources (materials or energy) recovered. Markets must exist and the resources recovered must meet the specifications of the end users.

The Solid Waste Management — Resource Recovery Plan was developed in conjunction with a market feasibility study of secondary materials.[11] This market analysis concluded that most of the materials (paper, metal, glass) within the waste stream have markets within reasonable shipping distances (see Figure 1, *infra* page 5). Presently over 190,000 tons of marketable materials with an economic value of $2.5 million are buried in landfills (see Table 2, *infra*, page 4).

Of the many grades of discarded paper and paper products only newsprint and corrugated paper are easily collectable as segregated items. The remaining categories are recoverable only in a broad "mixed paper" category, composed of low and high quality mixed paper. The quality of the secondary paper determines its end use. For example, only newsprint grade waste can be used to manufacture newsprint paper. This means that the characteristics of waste paper dictate the manufacturing requirements. Therefore, to find a market for waste paper a guaranteed supply with guaranteed specifications is necessary.

The metal presently landfilled is essentially composed of steel cans (beverage and food containers) and small appliances. Steel cans represent nearly 90 percent of the ferrous materials contained in the municipal waste stream. Automobiles and other bulky metallic items are diverted directly to junkyards and scrap dealers (*infra*, page 46). Like paper manufacturers, the steel-maker requires a consistent source of supply, in quality and quantity.

The last category for materials for which end users have been identified is glass. Ninety percent of the glass contained in the municipal waste stream is container glass. Recycled glass (cullet) increases the efficiency of glass making. However, it is only a desirable product once it is color-sorted, for each color of new glass can only use the same color of cullet.

No markets for rubber tires and plastic have been found and lack of technology limits recycling. Several reuse techniques have proved feasible on a pilot scale: artificial reefs, carbon black, asphalt additives, destructive distillation. However, potential end users are too far from Vermont to be within economic reality.

Markets have been found for about 60 percent of the solid waste generated in Vermont. However, all materials entering landfills are not available for recovery. Some are lost in the system, some are too contaminated to be recyclable or reusable and others would be too expensive to retrieve.

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[9] i.e., approximately $1.00 weekly service charge per household. In Vermont's urban areas where organized collection is most extensive, the average household (3.3 persons) generates 2.4 tons of refuse per year.

[10] There is a cost associated with bringing the trash to the disposal site. However, it is generally not associated with a direct out-of-pocket cost for collection services.

[11] Conducted for the Agency of Development and Community Affairs of the State of Vermont.

TABLE 2

ECONOMIC VALUE OF WASTE STREAM

	Total Municipal Waste Stream (3,132,000 tons)	Estimated Net Price per ton[3]	Estimated Revenue $
PAPER	cardboard 222,000	$20.00	4,440,000
	newsprint 388,000	12.00	4,656,000
	low quality mixed[1] 480,000	5.00	2,400,000
	high quality mixed[2] 241,000	30.00	7,225,000
GLASS	331,000	10.00	3,310,000
METAL	278,000	12.00	3,336,000
ORGANIC	755,000	0	0
OTHER	437,000	0	0
		TOTAL	$25,400,000[4]

---

[1] Low quality mixed paper includes magazines and other uncoated low quality papers.

[2] High quality mixed paper includes tabulating cards, computer printouts and other high quality office waste papers.

[3] After shipping expenses.

[4] To nearest $100,000.

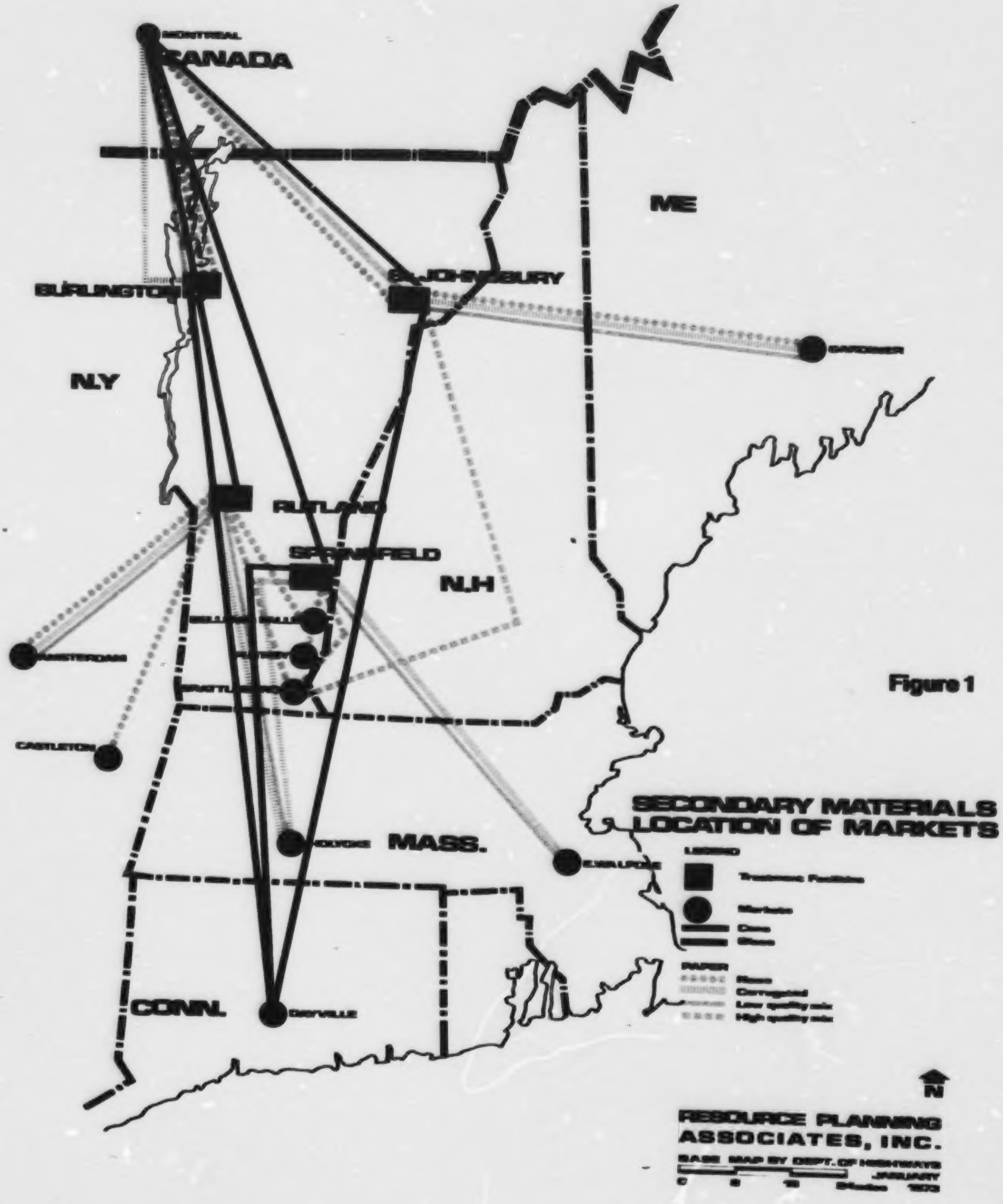

MONTREAL
CANADA
ME
BURLINGTON
ST. JOHNSBURY
GARDINER
N.Y
RUTLAND
SPRINGFIELD
N.H
AMSTERDAM
BRATTLEBORO
CASTLETON
HOLYOKE
MASS.
CONN.
DAYVILLE
SECONDARY MATERIALS
LOCATION OF MARKETS
LEGEND
Treatment Facilities
Markets
Cans
Glass
PAPER
News
Corrugated
Low quality mix
High quality mix
N
RESOURCE PLANNING
ASSOCIATES, INC.
BASE MAP BY DEPT. OF HIGHWAYS
JANUARY
1973

Figure 1

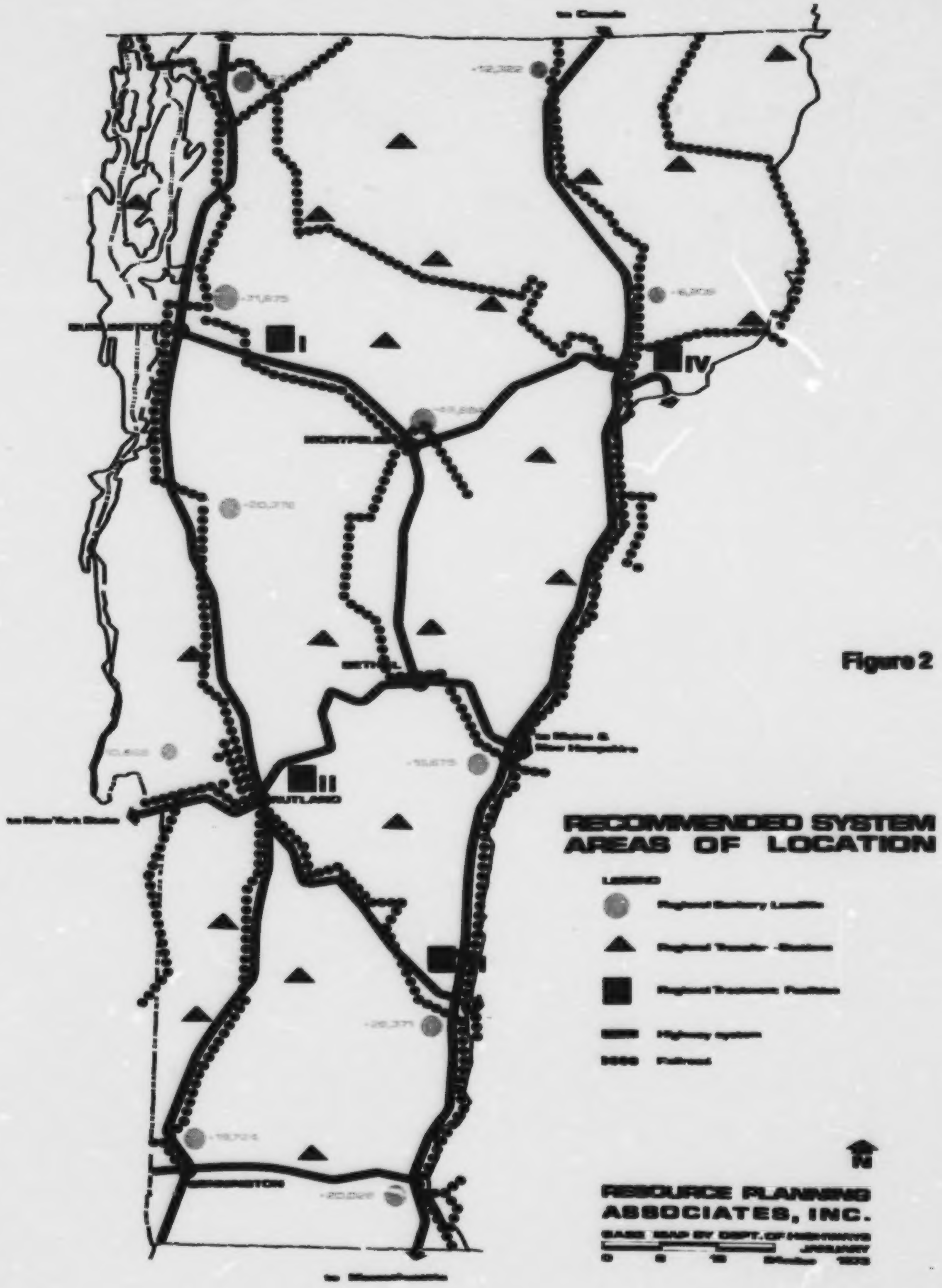

to Canada
I
IV
MONTPELIER
+12,322
+71,675
+20,776
BETHEL
to Maine &
New Hampshire
II
RUTLAND
to New York State
+26,371
+19,724
BENNINGTON
to Massachusetts
LEGEND
● Regional Sanitary Landfills
▲ Regional Transfer Stations
■ Regional Treatment Facilities
Highway system
Railroad
N
0 5 10 Miles

Figure 2

RECOMMENDED SYSTEM
AREAS OF LOCATION

RESOURCE PLANNING
ASSOCIATES, INC.
BASE MAP BY DEPT. OF HIGHWAYS
JANUARY 1973

Figure 3

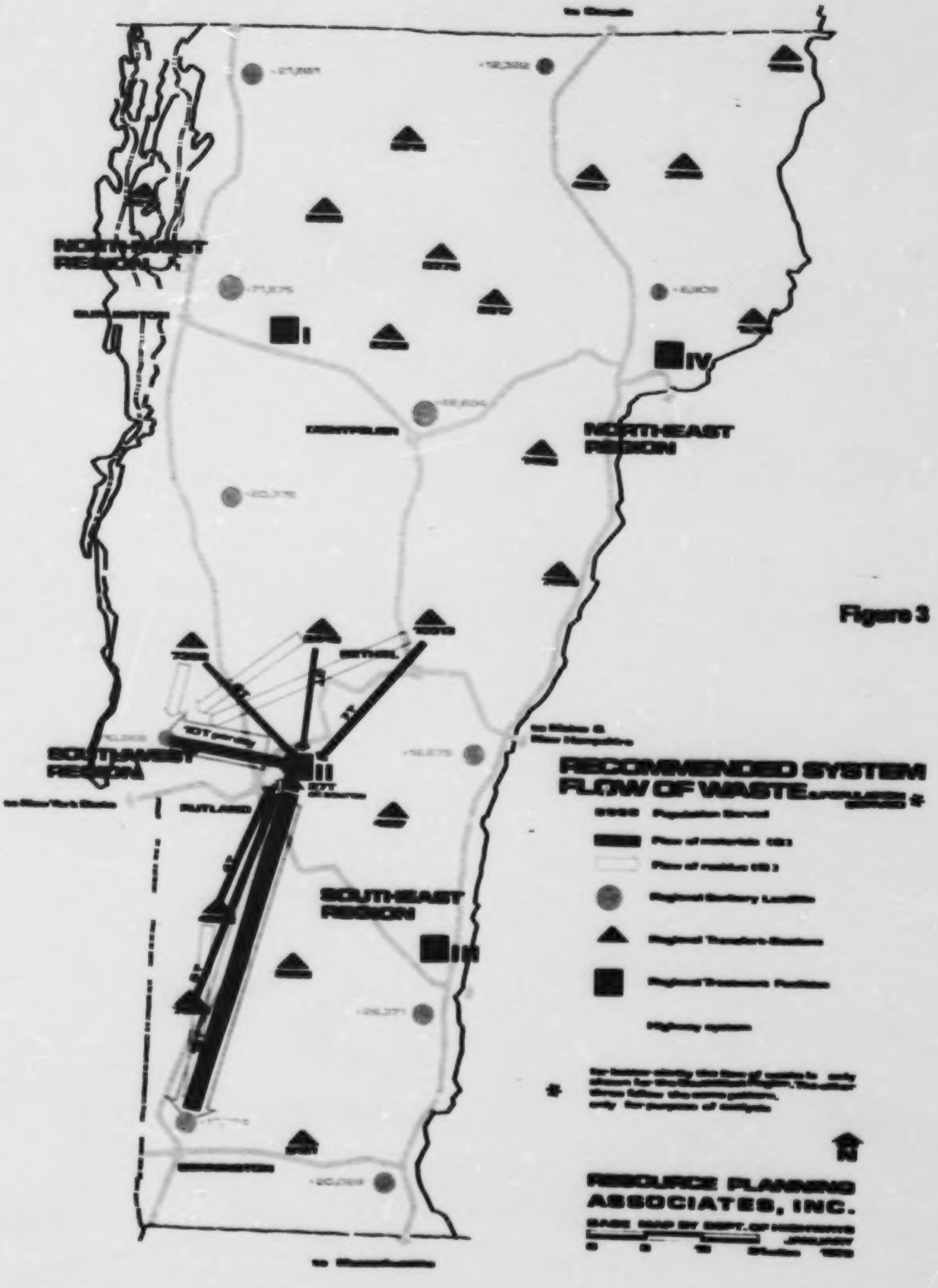
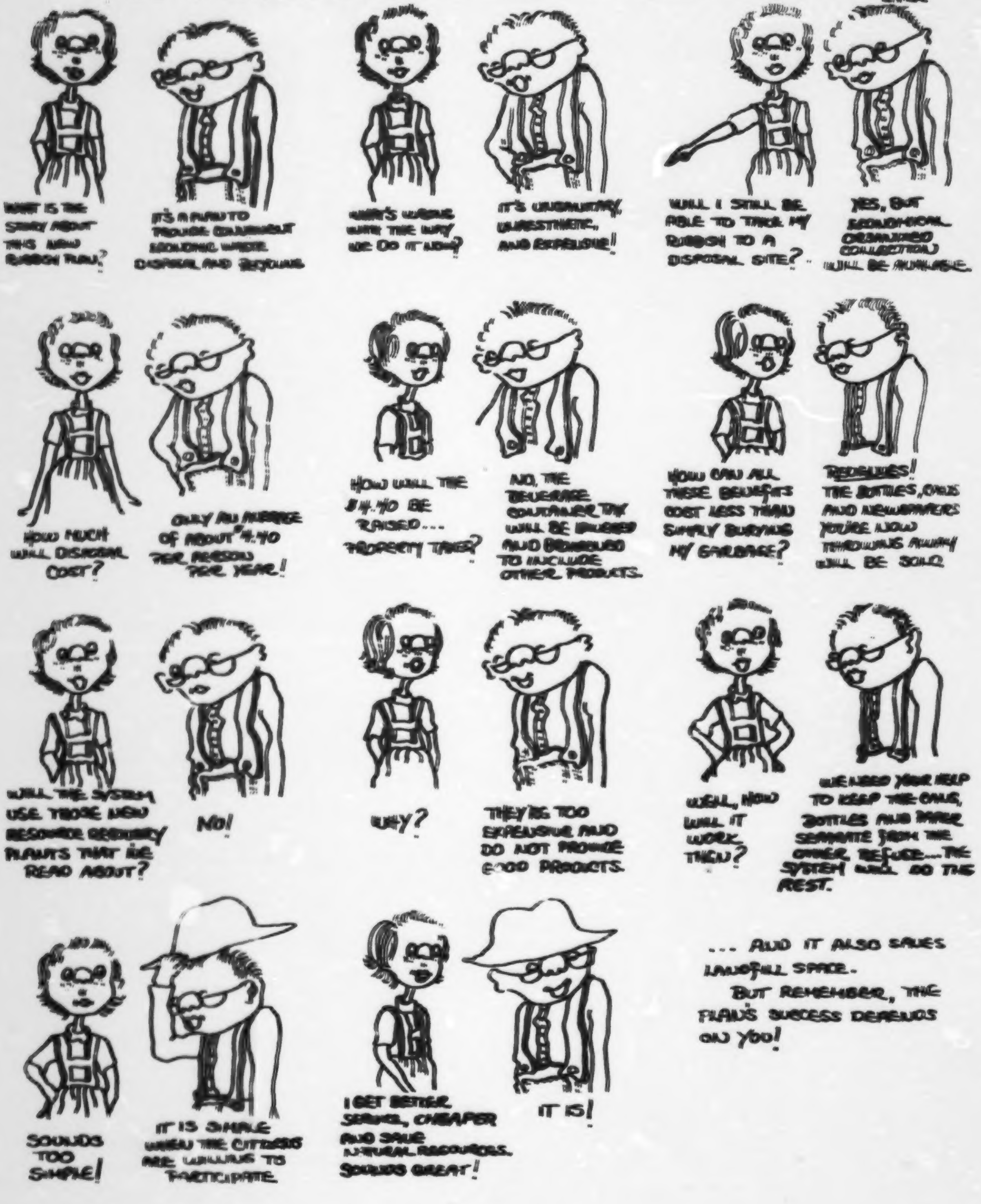

to Canada
NORTHWEST REGION
BURLINGTON
I
IV
MONTPELIER
NORTHEAST REGION
BETHEL
SOUTHWEST REGION
II
to New York State
RUTLAND
to Maine & New Hampshire
SOUTHEAST REGION
III
BENNINGTON
to Massachusetts
RECOMMENDED SYSTEM
FLOW OF WASTE
Population Served
Flow of materials
Flow of residue
Regional Sanitary Landfills
Regional Transfer Stations
Regional Treatment Facilities
Highway system
N
RESOURCE PLANNING
ASSOCIATES, INC.
BASE MAP BY DEPT. OF HIGHWAYS
0 5 10 Miles

Figure 4

A VERMONTER'S LOOK AT THE PLAN


WHAT IS THE STORY ABOUT THIS NEW RUBBISH PLAN?
IT'S A PLAN TO PROVIDE CONVENIENT SOUND WASTE DISPOSAL AND RECYCLING
WHAT'S WRONG WITH THE WAY WE DO IT NOW?
IT'S UNSANITARY, UNAESTHETIC, AND EXPENSIVE!
WILL I STILL BE ABLE TO TAKE MY RUBBISH TO A DISPOSAL SITE?
YES, BUT ECONOMICAL ORGANIZED COLLECTION WILL BE AVAILABLE.
HOW MUCH WILL DISPOSAL COST?
ONLY AN AVERAGE OF ABOUT $4.40 PER PERSON PER YEAR!
HOW WILL THE $4.40 BE RAISED... PROPERTY TAXES?
NO, THE BEVERAGE CONTAINER TAX WILL BE INCREASED AND BROADENED TO INCLUDE OTHER PRODUCTS.
HOW CAN ALL THESE BENEFITS COST LESS THAN SIMPLY BURYING MY GARBAGE?
REVENUES! THE BOTTLES, CANS AND NEWSPAPERS YOU'RE NOW THROWING AWAY WILL BE SOLD
WILL THE SYSTEM USE THOSE NEW RESOURCE RECOVERY PLANTS THAT WE READ ABOUT?
NO!
WHY?
THEY'RE TOO EXPENSIVE AND DO NOT PROVIDE GOOD PRODUCTS.
WELL, HOW WILL IT WORK, THEN?
WE NEED YOUR HELP TO KEEP THE CANS, BOTTLES AND PAPER SEPARATE FROM THE OTHER REFUSE... THE SYSTEM WILL DO THE REST.
SOUNDS TOO SIMPLE!
IT IS SIMPLE WHEN THE CITIZENS ARE WILLING TO PARTICIPATE
I GET BETTER SERVICE, CHEAPER AND SAVE NATURAL RESOURCES. SOUNDS GREAT!
IT IS!
... AND IT ALSO SAVES LANDFILL SPACE.
BUT REMEMBER, THE PLAN'S SUCCESS DEPENDS ON YOU!

C. RECOMMENDED PLAN

Outline of Section C

	Page
1. Solid Waste Management Alternatives	9
2. Recommended System	11
• Disposal	11
• Resource Recovery	11
• Storage-Collection	12
3. Recommended Management Plan	15
4. Financing Alternatives	17
5. Implementation Program	18

1. Solid Waste Management Alternatives

At an early stage of this study many alternatives were considered for Vermont in each of the categories of solid waste management (storage-collection, *disposal*, *resource recovery*).[12] As indicated in Table 3, several options do not meet the requirements set forth by the State of Vermont for its solid waste management-resource recovery plan. These requirements are: maximum practical level of recycling, minimum disposal on land, 100 percent of population served, maximum flexibility and minimum capital and operating costs (supra, page 1).

The optimum plan for Vermont in terms of maximum resource recovery, lowest costs and flexibility, will initiate material recovery through simple processing and source separation, consolidate the existing "approved" landfills and open-dumps into regional sanitary landfills and establish regional transfer stations. These concepts will be clarified in the following sections, which describe in greater detail the Solid Waste Management-Resource Recovery Plan (hereafter the "Plan") recommended for Vermont. This Plan is composed of four parts:

- the system recommended for disposal, resource recovery and storage-collection;
- the management organization required to develop and operate the system;
- financing alternatives to support the Plan; and
- implementation program.

Table 4 summarizes the major recommendations related to each part of the Plan.

TABLE 3
SOLID WASTE MANAGEMENT ALTERNATIVES

		Alternatives Summary Description[1]	Objectives					
			Minimum Cost		Maximum Practical Level of Recycling	Minimum Disposal on Land	100 Percent of Population Served	Maximum Flexibility
			Capital[2] ($000,000)	Operating[3] (per ton)				
I. SANITARY LANDFILLS	A	• *Upgrade* existing and close open dumps • Build regional transfer stations to serve 100 percent of population	2.5	$5.00	Not Achieved	Not Achieved	Achieved	Achieved
	B	• *Consolidate* existing disposal sites into regional sanitary landfills • Build regional transfer stations to serve 100 percent of popul population	2.1	$4.25	Not Achieved	Not Achieved	Achieved	Achieved
II. ENERGY RECOVERY		• Build energy recovery plant • Alternative I-B for disposal of residue	12-15	$10-30	Partially Achieved	Partially Achieved	Achieved	Not Achieved
III. MATERIAL RECOVERY	A	• Build large automated recycling plant for *mixed refuse* • Alternative I-B for disposal of residue	12-15	$10-30	Partially Achieved	Partially Achieved	Achieved	Not Achieved
	B	• Build simple processing plant for *mixed refuse* • Alternative I-B for disposal of residue	5-7	$4.25	Partially Achieved	Partially Achieved		Not Achieved
	C	• Build simple processing plant for [illegible] • Alternative I-B for disposal of residue	[illegible]	[illegible][4]	[illegible]	[illegible]	[illegible]	[illegible]

[1] See Appendix I, *infra* page 52 for economic analysis.

[2] Capital refers to *additional* capital expenditures necessary above current level, including development costs, and 20 percent contingency on estimated capital.

[3] Operating cost refers to *net* operating cost per ton, system fully operational.

[4] For 1975, operating cost is estimated at $4.80 per ton; for 1980, the figure is $2.65.

▨ Recommended alternative by Plan

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[12] For a detailed economic analysis, see Appendix I, *infra* page 52.

TABLE 4
SUMMARY RECOMMENDATIONS

Activities	Goals	Recommendations	Page
STORAGE: COLLECTION	• Give access to 100 percent of population to sanitary disposal within acceptable driving time. • Guarantee consistent volume of supply to treatment facilities. • Reduce traffic of private cars through system.	• Move toward organized collection services of segregated refuse. • Build Regional Transfer Stations so that no one person in the State has to drive more than 20 minutes or 12 miles. • Acquire trailer-trucks to haul residue and materials between transfer stations, treatment facilities and regional landfills. • Consolidate the existing "approved" landfills and open-dumps into Regional Sanitary Landfills. • Implement mandatory separation and build Regional Treatment Facilities to achieve 40 percent recovery (by weight). • Achieve further reduction of waste stream through other processing methods, e.g., incineration, composting, methane production and source reduction	12 12 12 11 12 App. III
DISPOSAL	• Minimize the use of land for disposal of municipal refuse. • Serve 100 percent of population with sanitary landfill.		
RESOURCE RECOVERY	• Achieve the maximum practical level of recycling.		
MANAGEMENT	• Secure maximum involvement of private sector. • Gain economies of scale wherever possible. • Minimize administrative overhead to the State. • Guarantee maximum managerial flexibility.	• Authorize and organize single state entity to develop and implement the State Solid Waste Management = Resource Recovery Plan.	15
FINANCE	• Minimize costs to the State's inhabitants. • Avoid use of property tax and/or State obligations as funding sources.	• Delay mandatory deposit. • Finance Plan with solid waste management fee.	App. II 17
IMPLEMENTATION	• Maximize flexibility in system and management • Minimize risks.	• Take an incremental approach and phase in system's hardware over next 7 years: • 1977: all regional sanitary landfills operational • 1979: Resource Recovery system fully operational.	18

2. Recommended System for Disposal, Resource Recovery and Storage-Collection

Figures 2 and 3, *infra*, pages 6 and 7, indicate the major characteristics of the recommended system. The private individual (i.e., households, retail stores, industrial establishments, public agencies) and private collectors bring their segregated materials and residue to any treatment facility, regional landfill or transfer station, whichever is most convenient.

From these "collection centers" the segregated material is hauled to the nearest treatment plant and the residue to the nearest regional sanitary landfill. To evaluate the overall economics of the system, the consultant had to choose among several location alternatives. It must be understood that the locations of the regional treatment facilities, sanitary landfills and transfer stations as indicated on the maps are by no means definite or final.

Disposal-Recommendations. To secure the savings associated with large sanitary landfill operations, consolidation of the existing small "approved" landfills and open-dumps into regional sanitary landfills is recommended. Regional sanitary landfills are the only way for Vermont to meet its future requirements. The locations of these regional sanitary landfills, as shown on Figure 2, *infra*, page 6, were defined as functions of the sources of waste generation, the overall convenience of the population, the existing "approved" landfill and dump operations and the availability of land for potential new sites.

These regional sanitary landfills would serve more than 275,000 inhabitants; more than 60 percent of the population will be living within a 12 mile radius of a regional sanitary landfill.[113] Resource Planning Associates estimates that the current capital investment in "approved" landfills of $1,150,000 will not have to be increased to meet the requirements of less than a dozen regional landfills operating according to EPA guidelines. Average operating cost per ton sanitary landfilled will be $3.25.[114] Table 5 outlines disposal recommendations for specific solid wastes.

Resource Recovery — Recommendations.[115] Resource Planning Associates estimates that two-thirds of the marketable materials in the municipal waste stream can and should be recovered through mandatory source separation. The first step in any resource recovery system is separation of the materials from the waste stream. It will be no more difficult for individuals to bring their segregated waste to the disposal site or transfer facility than it was to bring mixed refuse.[116] (See *infra*, page 15 for impact on organized collection system.)

As shown in Table 6 the materials to be segregated would vary according to the source of generation. For example, a lumber manufacturer will not be asked to segregate beverage containers, but containers are a major category of segregated materials for households and restaurants.

Steel and aluminum cans and clear glass containers are to be separated. The major reason for retaining clear glass in preference to colored is that the technology involved with color sorting of glass is still too expensive for Vermont and because clear glass represents the bulk (50 to 60 percent) of the glass in the municipal waste stream.[117]

Table 5
DISPOSAL RECOMMENDATIONS FOR SPECIAL WASTES

Special Waste	Limitation on Disposal Site[1]	Processing and Disposal Method
Bulky Metallic Items	• Accepted only at Bulky Metallic Depositories (may be regional sanitary landfill)	• Crushed and recovered • Residue (e.g., upholstery) landfilled
Demolition Waste	• Accepted only at regional sanitary landfills	• Landfilled (special area)
Shrubs and Trees	• Shredded or chipped shrubs and trees accepted anywhere • Large shrubs and trees accepted only at regional sanitary landfills	• If sufficient volume chipped and composted • Landfilled (special area)
Tires	• No limitation	• Stockpiling for shipment to reclaiming mills • Deep burial sanitary landfill (shredded if sufficient volume)
Waste Oils	• Accepted without limitations (regional sanitary landfills equipped with underground heated tank)	• Shipped to salvage companies for cleaning and reuse
Sewage Sludge	• Accepted only at regional sanitary landfills	• Sludge digestion and land application or landfill
Hazardous Waste	• Accepted only at regional sanitary landfills	• Neutralized and landfilled (special area) — Reprocessed

[1] Disposal sites are regional sanitary landfills, treatment facilities or transfer stations.

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[113] The regional sanitary landfill also serves as a transfer station. The remaining 40 percent of the population will be living within a 12 mile radius of a treatment facility or a regional transfer station. See *infra*, pages 11 and 12.

[114] See Appendix II, *infra*, page 52.

[115] The impact of the mandatory deposit bill on the recommended system is discussed in Appendix III, *infra*, page 62.

[116] A survey on metropolitan housewives' attitudes toward solid waste disposal conducted by National Analyst, Inc. for the Environmental Protection Agency (July 1972), found that "... virtually all metropolitan housewives (87%) express willingness to separate their trash to facilitate recycling. About half feel that such activity should be mandatory rather than voluntary."

[117] A Sortex Electronical Optical Sorter would require an additional investment of $120,000 per treatment facility. In addition, the specifications of the end user identified for Vermont's glass preclude electronic color sorting.

TABLE 6
LEVELS OF SOURCE SEPARATION

Materials with identical symbols go into the same container. For example, households, hotels, bars, and restaurants will segregate their waste into two containers. Container No. 1 will collect steel and aluminum cans and clear glass. Container No. 2 will collect amber and green glass and all other refuse. Newspapers will be bundled. The levels of separation for this source will therefore be two separate containers and a news bundle.

MUNICIPAL WASTE STREAM COMPONENTS[1]		SOURCES OF SOLID WASTE GENERATION		
		Households, Hotels Bars, Restaurants	All retail stores (dept. stores, supermarkets etc.)	Other commercial and industrial sources
PAPER	Newsprint	bundle	▣	bundle
	Cardboard	◎	bundle	bundle
	High Quality Mixed	◎	▣	▣
	Low Quality Mixed	◎	▣	◎
GLASS	Clear	△	△	◎
	Amber	◎	◎	◎
	Green	◎	◎	◎
CANS	Steel	△	△	◎
	Aluminum	△	△	◎
OTHER	Other materials	◎	◎	◎
	Garbage	◎	◎	◎
Levels of separation		2 containers + newsbundle	3 containers + cardboard bundle	2 containers + cardboard bundle + newsbundle

[1] Considers only the waste currently going into landfills.

The second step in resource recovery is the reprocessing of segregated materials to meet the specifications of end users. Because of the small quantities of waste generated in Vermont (less than 860 tons per day) only four treatment facilities are feasible over the next seven years. At each treatment facility presorted paper is baled and metal cans are magnetically separated from clear glass and aluminum cans before bundling and packing (aluminum cans are air separated from the clear glass which is then crushed). Figure 5, *infra*, page 13, is a conceptual design of the type of simple treatment facility recommended for Vermont. Figure 6, *infra*, page 13, illustrates the process flow of such a processing plan.

The structures of the markets (size, price offered, shipping costs, specifications) for each material recovered were carefully analyzed (see Figure 1, *infra*, page 5). Market considerations are a key determinant of treatment facility locations. locations.

In their capacity of transfer station, the four regional treatment facilities will serve directly more than 74,000 people; more than 15 percent of the population will be living within a 12 mile radius of a regional treatment facility.[118]

The capacity of each treatment facility would be 1,000 to 1,200 tons of materials per week. The capital cost for the treatment facilities will be $2.2 million, and yearly operating cost $860,000. At net prices (after shipping to market) of $5 to $30 per ton, marketable materials should provide revenue of $13.00 per ton of processed materials. A detailed analysis of each region was made to take into account variations in the composition and generation of waste, as well as the location of markets. Table 7 summarizes the revenue, processing costs and contributions generated at each regional treatment facility.

The maximum practical level of resource recovery, with source separation is estimated at 35 to 40 percent by weight of the municipal waste stream. At projected rates of per capita contribution approximately 520,000 tons of waste will be generated in the year 1982. In that year, the 60 percent of unrecovered waste will be equal to the current total municipal waste stream of 313,000 tons per year. Reduction of the percentage of unrecovered waste is essential to achievement of the goal of minimum use of land for disposal. The following techniques to improve waste processing are considered in more detail in Appendix III, *infra*, page 65: incineration, garbage grinding, methane production, composting and source reduction.

Storage-Collection-Recommendations. The concern of this section is the definition of a collection system which will serve 100 percent of the population with a sanitary means of disposal. Storage and collection standards for segregated materials remain to be developed. Adequate equipment presents no problems, but it is not the aim of this section to recommend specific pieces of equipment or techniques.

The following system is based upon two assumptions: no one in the State drives more than 12 miles or 20 minutes to dispose of refuse; local units (private or municipal) are not providing statewide organized collection services.

On these two assumptions, twenty regional transfer stations would have to be built to give the population not directly served by a regional sanitary landfill or treatment facility access to a sanitary means of transfer to disposal. The size and capacity of each transfer station would have to be adapted to the area it served. Ninety-one thousand inhabitants would be served by these regional transfer stations. The residue collected would be hauled to the nearest regional landfill and the materials to the nearest treatment facility. Figure 7, *infra*, page 14, presents a conceptual design of a large transfer station, and figure 8, *infra*, page 14, the process flow of a transfer station. The total capital investment, including the hauling equipment to move residue and materials, would be approximately $2,000,000. Transfer costs of such a system include operating and hauling costs; operating costs of the entire transfer station network would be $380,000 per year and hauling costs, depending on the type of truck, would vary between $350,000 and $450,000 per year.[119]

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[118] The treatment facility has two capacities: (1) processing of recovered materials and (2) transfer station.

[119] Hauling costs include the hauling of materials from regional landfills to treatment facilities, and the hauling of residue from treatment facilities to regional sanitary landfills. These figures are based on a total freight of approximately 110,000 tons of material and 60,000 tons of residue.

Figure 5

CONCEPTUAL DESIGN OF A TREATMENT FACILITY

▨ [illegible]

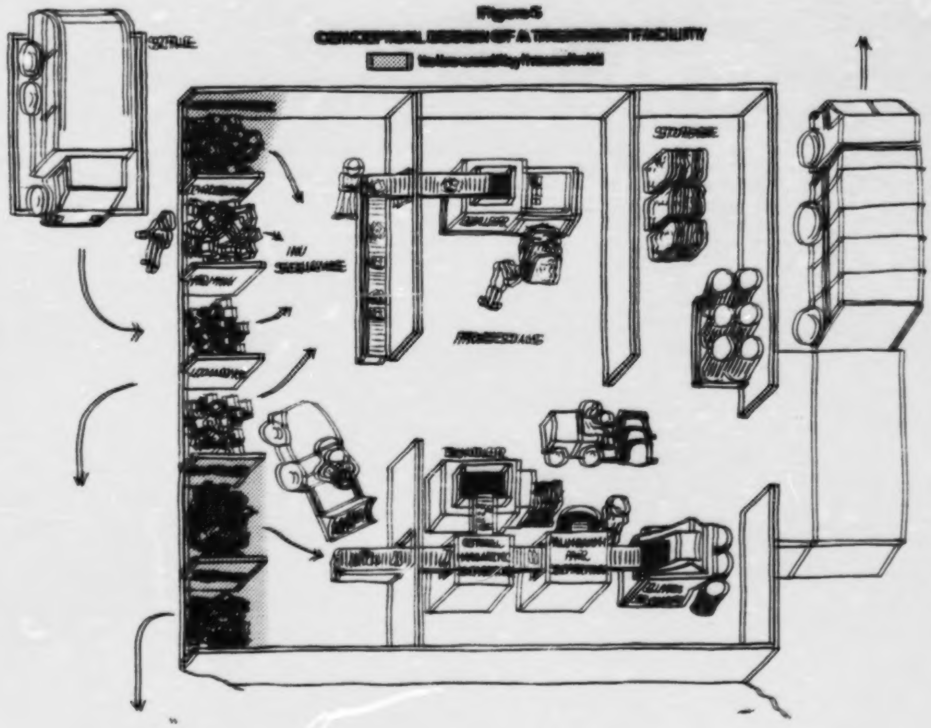
STORAGE
PROCESSING

Figure 6

PROCESS FLOW OF A TREATMENT FACILITY

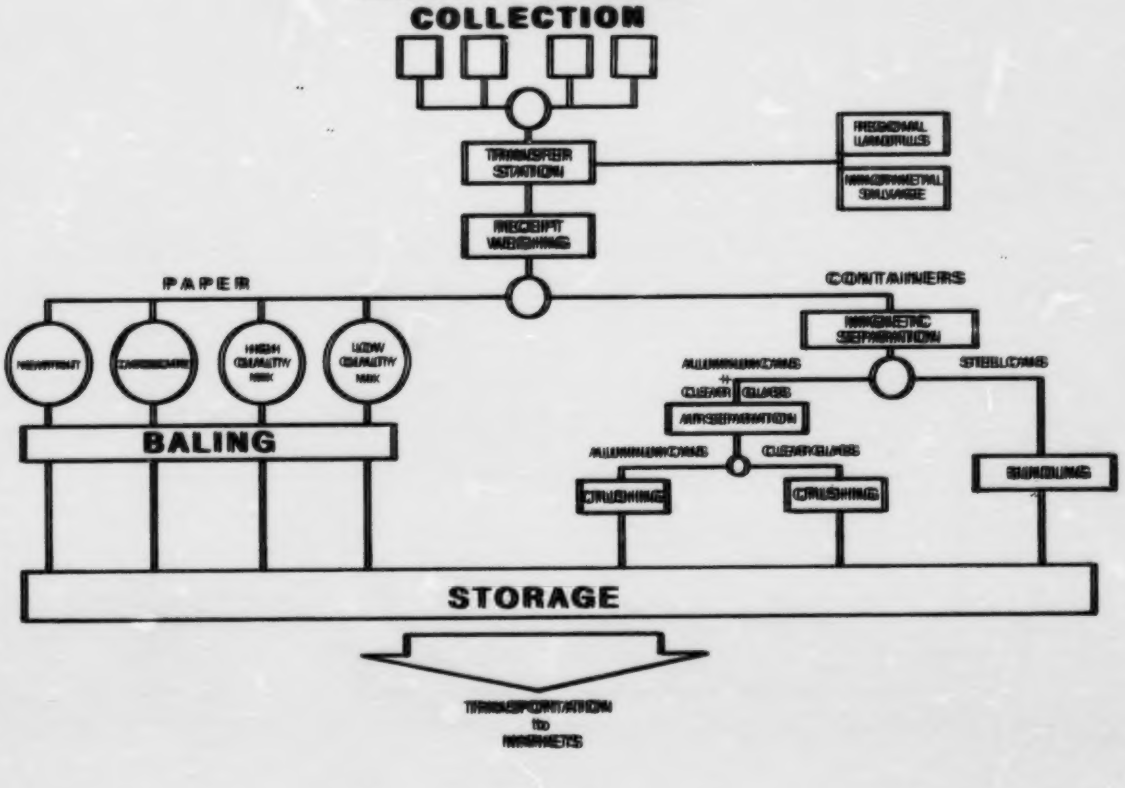
COLLECTION
TRANSFER STATION
REGIONAL LANDFILLS
METAL SALVAGE
RECEIPT WEIGHING
PAPER
CONTAINERS
NEWSPRINT
CARDBOARD
HIGH QUALITY MIX
LOW QUALITY MIX
BALING
MAGNETIC SEPARATION
ALUMINUM CANS + CLEAR GLASS
STEEL CANS
AIR SEPARATION
ALUMINUM CANS
CLEAR GLASS
CRUSHING
CRUSHING
BUNDLING
STORAGE
TRANSPORTATION to MARKETS

Figure 7

CONCEPTUAL DESIGN OF A LARGE TRANSFER STATION

▨ [illegible]

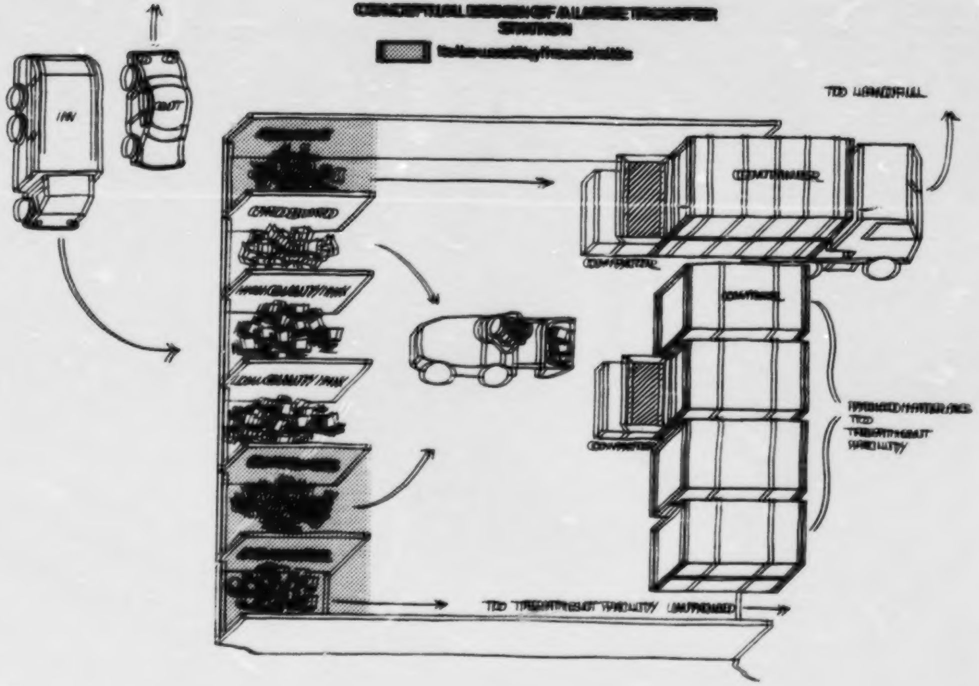
TO LANDFILL
CONTAINER
CARDBOARD
HIGH QUALITY MIX
LOW QUALITY MIX
CONTAINER
PROCESSED MATERIALS TO TREATMENT FACILITY
TO TREATMENT FACILITY UNPROCESSED

Figure 8

PROCESS FLOW OF A TRANSFER STATION

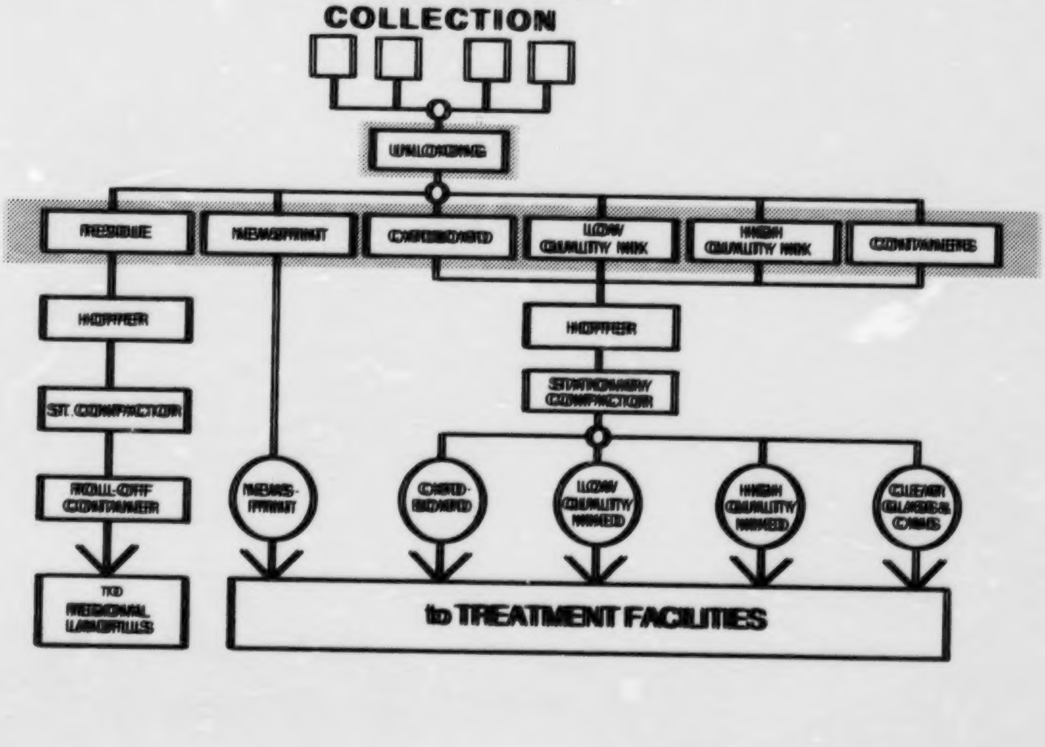
COLLECTION
UNLOADING
RESIDUE
NEWSPRINT
CARDBOARD
LOW QUALITY MIX
HIGH QUALITY MIX
CONTAINERS
HOPPER
ST. COMPACTOR
ROLL-OFF CONTAINER
TO REGIONAL LANDFILLS
HOPPER
STATIONARY COMPACTOR
NEWS-PRINT
CARD-BOARD
LOW QUALITY MIXED
HIGH QUALITY MIXED
CLEAR GLASS & CANS
to TREATMENT FACILITIES

Table 7

RECOVERED MATERIALS – CONTRIBUTION GENERATED TOWARD COLLECTION, TRANSFER COSTS AND DISPOSAL[1]

Dollars Per Processed Ton

MATERIALS RECOVERED		TREATMENT FACILITIES				
		BURLINGTON AREA	ST. JOHNSBURY AREA	RUTLAND AREA	SPRINGFIELD AREA	STATE AVERAGE
PAPER	Revenue from Paper	113.90	113.45	114.60	114.60	114.00
	Processing Cost	4.75	7.00	8.10	10.10	6.90
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CONTAINERS	Revenue from Cans & Glass	110.90	110.00	111.85	111.90	112.30
	Processing Cost	3.80	5.60	6.90	8.10	5.00
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[1] Based on 125,000 tons of material, i.e., 40 percent recovery of current municipal waste stream.

Relaxing one or both of the initial assumptions has a drastic impact on the layout and total costs of the transfer station network. The system of twenty transfer stations is a rather conservative solution. For example, if it is assumed that 25, rather than 12, miles is a reasonable distance to travel, then no more than five transfer stations would be necessary.

Similarly, as collection moves toward statewide services, fewer transfer stations are required. Statewide organized collection would lower costs in two ways: reducing transfer station costs and minimizing the cost increases associated with the acquisition of new collection equipment required for handling segregated waste. Statewide collection would guarantee a consistent volume of supply to treatment plants and facilitate operation of the entire system.[20] Therefore, the Plan recommends re-routing existing collection to gain maximum efficiency and moving toward statewide collection services.

Assessing the level of additional organized collection costs under segregated collection is difficult, for there is little experience in other municipalities and states with which to compare. The City of Madison, Wisconsin's newspaper salvage project reported collection costs for news at $3.09 per ton during the October 1, 1970, to February 28, 1971 period.[21] Resource Planning Associates, in a tax credit incentive study for the Federal EPA, calculated additional collection costs under segregated collection at the national level at $3.07 per ton.[22]

With these levels of collection costs, resource recovery appears to be feasible on a statewide basis. However, other studies such as the Camp-Dresser's Erie-Niagara County Study for the State of New York, have indicated sharply higher collection costs (e.g., $15.00 per ton) under mandatory segregated collection. Certainly, before implementing recycling, a detailed study of the impact of mandatory source separation on collection costs is required.

3. Recommended Management Plan

The management plan was formulated to meet 5 major objectives:

1. Maximum involvement of the private sector;
2. Economies of scale wherever possible in development, operations and administrative services;
3. Minimum administrative overhead[23] for the State;
4. Maximum local control without creating conflicting local jurisdictions;
5. Maximum management flexibility to accommodate future change.

Any solid waste management plan is assessed by its effectiveness in dealing with storage-collection, disposal and resource recovery (the 3 major activities defined and discussed *supra*, page 2). The organizations managing these three activities must perform five management functions: (1) development; (2) operation; (3) financing; (4) monitoring and enforcement; and (5) legal control.

Development may be defined as the provision of the necessary technical and administrative services to make the system operational. For example, Vermont's final program for mandatory domestic, commercial and industrial separation of paper and containers has yet to be developed. Performance specification and detailed operating procedures remain to be formulated for the first treatment facility, which will serve as a prototype for future facilities. Similar problems are involved at the levels of disposal and collection.

Operation encompasses actual day-to-day management and maintenance of a regional landfill, collection service, transfer station or treatment facility.

Financing is the underwriting of initial market and operating risks.

The *monitoring and enforcement* agency is charged with

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[20] Traffic of private vehicles will be reduced at each point.

[21] American Paper Institute, "It Matters to Madison" March 1971.

[22] These calculations assumed a 25 percent increase in collection truck capital costs from $30,000 per truck, a 5-year depreciation period, a 3-man work crew at $4 per man hour with productivity of 8 tons/day, and a 15 percent increase in collection time for segregated wastes.

[23] Administrative overhead means administrative expenses not chargeable to particular task or work.

Table 8

RECOMMENDED MANAGEMENT ORGANIZATION

Solid Waste Activities	Management Functions				
	Development	Operation	Financing	Monitoring and Enforcement	Legal Control
Storage-Collection[1]	Private or Municipal[2]	Private or Municipal	Private or Municipal	State	Private or Municipal
Disposal (Regional sanitary landfills)	Private or Municipal[2]	Private or Municipal	Private or Municipal	State	Private or Municipal
Resource Recovery (transfer stations and treatment facilities)	State	Private	State	State	State

[1] For greater clarity transfer stations are included under resource recovery.

[2] State assistance

making necessary adjustments to accommodate change and enforcing standards for sanitary landfills, materials specifications and mandatory separation.

Legal control refers to ownership and ability to enforce legal rights.

These five management functions may be performed by various organizations: (1) the State; (2) regions; (3) municipalities or towns; (4) private enterprise. There are many possible combinations of organizational types with the five management functions, but only a few meet the objectives of the Plan. At the two extremes, the State could undertake all three solid waste management activities or localized private enterprises could be responsible for the entire system.

Advantages of a centralized, state-run system include economies of scale in development and administrative services, easy access to federal programs[24] and power to obtain necessary sanitary landfill sites (eminent domain). By controlling the entire system, the State is best able to accommodate change. While a system run by local units would have none of the above advantages, it has positive benefits lacking in a state system. Private sector involvement, local control, and minimum administrative overhead are furthered by a local system. In addition, private enterprise has experience in operating management and understands local procedures (especially in collection).

The Plan recommended by Resource Planning Associates maximizes the advantages associated with each type of organization and activity by allowing each type of organization to fulfill the function for which it is best suited. Table 8 outlines the Plan's management organization. Three major recommendations are made:

1. Operating control and maintenance should remain at the local level.
2. The State should assume the capital risks associated with the development of the recommended system concerning transfer stations and treatment facilities.
3. The State should monitor and enforce the standards for sanitary landfills, collection and resource recovery.

The implication of the above recommendations will become more clear in the following sections which describe the respective roles assigned to state and private enterprise in each category of solid waste management.

Storage-Collection. The State is best suited to provide overall guidelines (sample franchise agreements, rate guidelines, licensing procedures of private collectors) and technical assistance (techniques of collection of segregated materials). At the collection level local or regional government units should retain management responsibility for actual collection. These local units would have franchising authority as well as responsibility for developing local storage-collection requirements.

Disposal. At this level, the State can achieve significant economies of scale by following the Plan. Also, the State is in the best position to distribute these efficiency benefits to the individual Vermonter. Important savings can be realized by developing operating procedures for regional sanitary landfills and coordinating each region's specific needs and characteristics at the state level. Operator training programs as well as enforcement of performance standards would best be undertaken by the State. In addition, land development plans for completed sanitary landfills can be developed in conjunction with the State's overall land use plan.

If the State is best suited for the monitoring responsibility, local units (municipalities and private contractors), currently owning many appropriate sites, are most experienced in the disposal operation. There is absolutely no need to create administrative overhead at the state level by requiring the State to run sanitary landfill sites.

Resource Recovery. The State is the only body which can overcome imbalances stemming from the operation of treatment facilities located in different areas and generating different revenues. In addition, the State is the only body which can immediately initiate recycling throughout Vermont and take into account statewide starting costs.

The resource recovery system will not immediately operate at maximum effectiveness. Initially, operating costs will be above projected costs (see Table 10, *infra*, page 118, "Net Cost Per Ton" figures) until a significant level of recovery is obtained and economies of scale are achieved. Municipalities or private contractors are unlikely to underwrite the initial market and operating risks. Therefore, during the construction and starting phase, the State is best suited to develop economies of scale in planning and administration of the resource recovery system. This by no means precludes the State from eventually delegating actual operation to private industries (initially with financial support which would be terminated as the treatment facility becomes self-supporting). However, the State must retain control of the system.

A single State entity is the most effective agent for establishing markets for recycled materials. The entire State of Vermont generates as much solid waste in one year as the city of Baltimore, Maryland in two months. This comparatively small amount of waste precludes several contracting agencies from gaining the market leverage needed to obtain better contracts and to establish a long-term market. Also, end users prefer to deal with a single agency rather than numerous small units.

A single State contracting agency can achieve economies of scale in administration (e.g., model contractual agreements with end users) and is in a position to balance supply. The State is best able to set and enforce quality control standards and to monitor the collection, transfer and processing of recycled material; upon these key variables much of the success of resource recovery will depend.

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[24] Federal grants favor a statewide or regional approach to solid waste management.

Currently, the Air Pollution and Solid Waste Control Section within the Division of Protection of the Agency of Environmental Conservation has primary responsibility for solid waste management at the State level. The Plan recommends that responsibility for developing, monitoring and enforcing the Solid Waste Management-Resource Recovery Plan remain in this section. However, the Solid Waste Control Section will be expanded into three distinct units: (1) resource recovery, (2) surveillance and enforcement and (3) technical support (see Figure 9, *infra* page 119).

Each unit will be charged with the following responsibilities:[25]

(1) Resource Recovery
- Contact with end users
- Implement and monitor the recycling system
- Enforce mandatory separation

(2) Surveillance and Enforcement
- Implement the regionalization of sanitary landfills and transfer stations
- Monitor and enforce the collection and disposal standards
- Monitor special waste problems

(3) Technical Support
- Assist local communities in solid waste management
- Provide education and public information
- Implement training programs in conjunction with the two other units.

Total staff required for the three units would be thirteen. Five are already employed by the State on programs related to solid waste.[26] It is recommended that the person in charge of the resource recovery unit be responsible for the entire Solid Waste Programs Section; the person responsible for local community support should head the technical support unit. The personnel and skills desired for each unit are listed below:

(1) Resource Recovery	
Head (1)	Business Administration
Enforcement (2)	Administrative
Secondary Materials (1)	Technical
Bulky Metallic Waste (2)	Technical
(2) Surveillance and Enforcement	
Head (1)	Sanitary Engineering
Inspectors (2)	Technical
(3) Technical Support	
Head	Systems Engineering
Local Community Support (1) Public Relations and Training (1)	Technical and Administrative
Administrative Staff (2)	Secretarial

The total budget for the three units is estimated at $2,120,000[27] per year, $1,230,000 allocated to personnel and $890,000 to overhead costs. This represents an increase of $1,555,000 over the present level of direct expenditures in solid waste management. Table 9 presents the budget estimates by function for the solid waste programs section.

Existing laboratory facilities (Industrial Hygiene Unit, Water Resources Laboratory) will be adequate to meet the relatively modest needs of the three units.

4. Financing Alternatives

Proper financing is an absolute requirement for the implementation of the Plan. Table 10 delineates the funding requirements. See *supra*, page 111 for a description of the specific elements included in each cost category. The cost analysis used to establish the funding requirements is detailed in Appendix I, *infra*, page 52.

A number of alternative sources of funds were evaluated: general State revenues; bonds, both general obligation and revenue; leveraged leasing; bank loans; fee systems; private capital and federal monies. Each source has its advantages and drawbacks and each could be used to fund elements of the program. In reality, there will be a mixture of funding sources utilized. However, a basic level of earmarked funds should be authorized at the time the Plan is adopted by the legislature. This will insure that implementation activities begin immediately.

The level of funding need not cover all projected development, capital and operating needs, but should provide a minimum basis for operation. Resource Planning Associates' analysis indicates that $11.5 million dollars per year should be earmarked to implement the Plan. The difference between this minimum

TABLE 9

BUDGET ESTIMATES BY FUNCTION FOR SOLID WASTE PROGRAMS

		1973	1974	1975
1.	Resource Recovery			
	Personnel	328,700	447,200	447,200
	Overhead	225,000	385,000	385,000
	Contract Funds	2,590,000	–	485,000
2.	Surveillance and Enforcement			
	Personnel	332,200	332,200	332,200
	Overhead	390,000	390,000	390,000
	Contract Funds	1,190,000	–	–
3.	Technical Support			
	Personnel	113,800	225,300	225,300
	Overhead	110,000	110,000	110,000
	Contract Funds	225,000	225,000	200,000
4.	Management and Clerical Support			
	Personnel	225,300	225,300	225,300
	Overhead	5,000	5,000	5,000
TOTAL PERSONNEL		1,000,000	1,230,000	1,230,000
TOTAL OVERHEAD		730,000	890,000	890,000
TOTAL DIRECT OPERATING COSTS		1,730,000	2,120,000	2,120,000
TOTAL CONTRACT FUNDS		4,005,000	225,000	685,000
[redacted]		[redacted]	[redacted]	[redacted]

*Contract funds are part of development costs – see Implementation Program, *infra*, page 118).

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[25] For a detailed description of the tasks to be performed by each of these units as well as the skills required for each task, see Appendix V, *infra*, page 70.

[26] Three in the Air Pollution and Solid Waste Control Section (1 engineer, 1 technician, 1 secretary) and 2 in the Department of Highways under the bulky metallic waste program.

[27] Not including bulky metallic waste personnel and overhead.

Table 10

FINANCING NEEDS
(000 Dollars)

YEARS

	TOTAL	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
DEVELOPMENT	720	405	25	65	35	105	40	25	20	—	—
CAPITAL[1]	5140	85	880	785	640	700	1510	570	—	—	—
OPERATING											
Solid Waste Programs Section		170	220	220	220	220	220	220	220	220	220
Sanitary Landfills		800	1080	1200	1100	1080	880	830	850	830	800
Transfer Stations		—	—	70	140	190	240	385	390	390	380
Hauling of materials and residue		—	50	120	200	280	300	465	500	550	600
Treatment Facilities		—	100[3]	215	215	430[3]	430[3]	695[3]	860	880	880
TOTAL EXPENDITURES[4]		1480	2245	2675	2550	2925	3640	3140	2780	2810	2880
REVENUES[2]		—	—	115	615	720	960	1170	1535	1535	1680
TOTAL [illegible][4]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TONNAGE OF WASTE STREAM (000 tons)		325	*	367	*	*	*	*	471	*	*
NET COST PER TON		[illegible]	*	[illegible]	*	*	*	*	[illegible]	*	*

[1] Including 20% contingency on estimated capital.

[2] From the sale of materials recovered. Based on 125,000 tons of materials marketed in 1982.

[3] Treatment facilities on line.

[4] Excluding profit to private enterprises.

*No estimates made.

amount and the projected needs could be made up in several ways. For example, the Federal Environmental Protection Agency has indicated some monies might be available to defray development costs. Private solid waste management firms could also be used as a source of capital; some have already expressed interest in this possibility.

The $1.5 million will be adequate to get the program started and fully implemented. Rather than using traditional funding mechanisms that normally take some time to effect (general obligation and revenue bonds), it is proposed that a solid waste management fee be levied.

A number of bases for levying the fee were evaluated: weight of materials, volume, disposability and recyclability. After consultation with the Federal Environmental Protection Agency officials, each of these schemes were rejected because of the uncertainty of its impact (should heavy packages be taxed more; is glass less disposable than paper?, etc.) and the complex and costly administration requirements. Because the principal objective is to raise funds for the program and not to influence behavior of consumers or producers, the Environmental Protection Agency suggested a simple fee based on the selling price of the product. This system, although not totally equitable, would not have a marked effect on prices.

There are alternative ways that this type of fee could be assessed. The State of Washington has a scheme which assesses a one and one-half mill tax on the selling price of each product at the manufacturing, wholesale and retail level. A simpler version of this scheme would meet Vermont's financing needs.

It is proposed that a three mill fee (i.e., $3 per $1,000 of sales) be placed on all products sold at the retail level. This solid waste management fee would be administered in much the same manner as the existing sales tax and should raise at least $2 million. It is further proposed that $1.5 million be earmarked for the implementation of the Plan, and the remainder be allocated to local communities to defray collection costs.

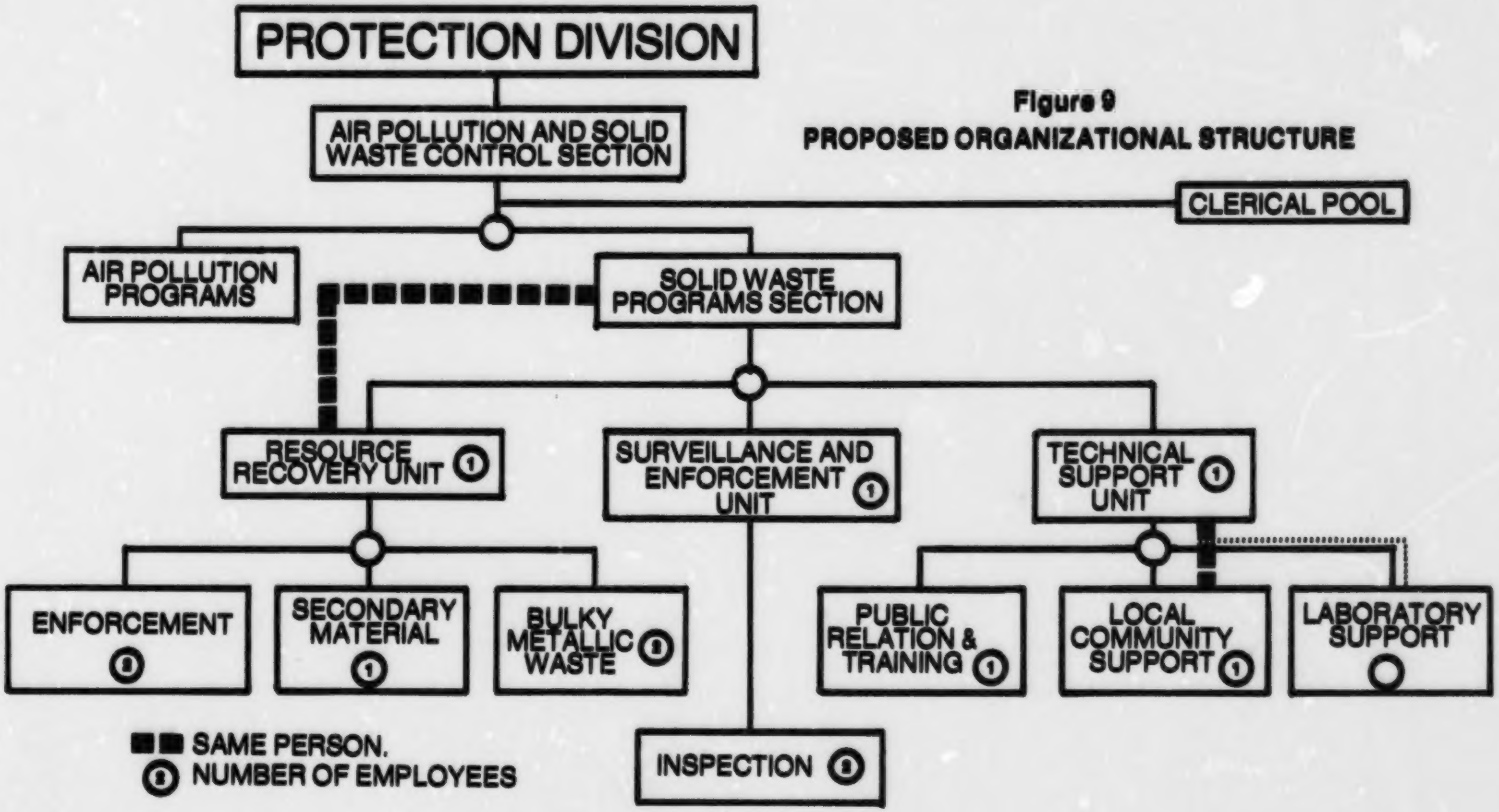
The primary concern is that the program be adequately funded, and the proposed solid waste management fee accomplishes this. It is recognized that there are a number of other adequate sources of financing. The solid waste management fee was selected primarily because it has two distinct advantages — timing and low administrative overhead.

5. Implementation Program

Effective implementation of the Solid Waste Management-Resource Recovery Plan will require several years. Table 11 outlines the steps necessary to initiate the Plan and proposes a chronological schedule of action for each solid waste activity (storage-collection, disposal, and resource recovery). Table 11 also estimates the cash outlays needed to develop and build the system over the next seven years. The activities performed by the solid waste programs section are marked with an asterisk, and no expenditures beyond the yearly operating budget of that section are necessary. The key dates of the program are:

1973: Legislative approval of the Plan
Establishment of the Solid Waste Programs Section
Closing of all open dumps.
1974: First treatment facility (Burlington area) operational
Mandatory separation effective
1977: All regional sanitary landfills operational
1978: All regional transfer stations operational
1979: The resource recovery system fully operational

During the transition phase from current disposal operations to the recommended system the present enforcement activities of the Air Pollution and Solid Waste Control Section will not be curtailed. Towns that are presently using open dumps will have to comply with the standards of the 1967 legislation. However, any effort from now on should attempt to be consistent with the Plan itself. For example, in some circumstances it may be better to go to the transfer station than to start a sanitary landfill. If a particular site will be in compliance with the Plan within a short period of time, (approximately a year), then a hearing procedure for an abatement schedule based on compliance with the State Plan may be considered. But there should be only short-term disposal abatement agreements between the municipality and the State.



PROTECTION DIVISION
AIR POLLUTION AND SOLID WASTE CONTROL SECTION
CLERICAL POOL
AIR POLLUTION PROGRAMS
SOLID WASTE PROGRAMS SECTION
RESOURCE RECOVERY UNIT ①
SURVEILLANCE AND ENFORCEMENT UNIT ①
TECHNICAL SUPPORT UNIT ①
ENFORCEMENT ②
SECONDARY MATERIAL ①
BULKY METALLIC WASTE ②
INSPECTION ②
PUBLIC RELATION & TRAINING ①
LOCAL COMMUNITY SUPPORT ①
LABORATORY SUPPORT
■■ SAME PERSON.
② NUMBER OF EMPLOYEES

Figure 9
PROPOSED ORGANIZATIONAL STRUCTURE

Table 11

IMPLEMENTATION PROGRAM

SOLID WASTE ACTIVITIES

1973	DEVELOPMENT ($000)	CAPITAL ($000)	1974	DEVELOPMENT ($000)	CAPITAL ($000)	1975
1. STORAGE – COLLECTION						
1. Locate sites for regional transfer stations throughout the State.	30		1. Develop engineering plans for transfer stations serving the Northeast region (bidding completed by Fall 1974).		50	1. Transfer stations serving the northeast region operational by mid 1975.
2. Develop operating procedures and performance specification for regional transfer stations.	80		2. Develop engineering plans for transfer stations serving regions where temporary disposal agreements are impossible (bidding completed by Fall 1974).		40	2. Transfer stations serving regions where temporary disposal agreements are impossible, operational by mid 1975.
3. Develop training program for operators of regional transfer stations.	•		3. New collection procedures operational in the Northeast Region by mid 1974.	•		3. Transfer station operator training program.
4. Aid local units in developing operational and organizational program for private haulers in the Northeast Region.	•		4. Secure financing for first phase construction.	•		4. Aid local units in developing operational and organizational program for private haulers in the Montpelier area.
5. Secure financing for transfer station system.	•					5. Develop engineering plans for regional transfer stations serving the Montpelier area. Bidding completed by Fall 1975.
						6. Secure financing for addition to existing system. • under assumed locations used for analysis, none to be built.
2. DISPOSAL						
1. Locate sites for regional landfills throughout the State.	20		1. Regional landfills serving the Northwest region, operational by mid 1974.			1. Regional landfills serving the Montpelier area, operational by early 1975.
2. Develop operating procedures, and performance specifications for regional sanitary landfills.	•		2 Sanitary landfill operator training program.	•		2. Sanitary landfill operator training program.
3. Develop training program for operators of sanitary landfills.	•		3. Develop engineering plans for regional landfills serving the Montpelier area, by fall 1974.			3. Phase out remaining landfills in Northwest region by mid 1975.
4. Develop engineering plan for regional landfills serving the northwest region by late 1973.						4. Review operating procedures and performance specifications of operating regional landfills – adjust for remaining landfills.
5. Close all existing dumps and work out temporary disposal agreements throughout the State	•					5. Develop engineering plans for regional landfills serving the southeast region by late 1975.
3. RESOURCE RECOVERY						
1. Contract with end users for volumes, prices, quality specifications and transportation arrangements.	•		1. Treatment facility I serving the Northwest region, operational by mid 1974.		620	1. Establish input and output requirements for first treatment facility.
2. Locate site for first treatment facility (Burlington area) serving the Northwest region: • get town approval • get purchase agreement or long-term lease on land		5	2. Mandatory separation effective by mid 1974. • papers and containers in Southwest region • news only in other parts of State	•		2. Mandatory separation of papers and containers for Montpelier area effective by early 1975. • Materials hauled to Burlington area treatment facility.
3. Develop program for mandatory domestic, commercial, industrial separation of papers and containers: • establish mandatory separation of papers and containers in the Northwest region • establish mandatory separation of news in other parts of state.	25		3. Operator training program for first facility.	•		3. Locate site for second treatment facility (Rutland area) serving the southeast region.
4. Develop performance specifications for first treatment facility by mid 1973 (to be used by others).	150		4. Develop program for mandatory separation of papers and containers for Montpelier area.	•		4. Review contracts with end users.
5. Develop architectural and engineering plans for first treatment facility by fall 1973. • bidding for construction and equipment completed by late 1973.		65	5. Public information program.	25		5. Review performance specifications and operating procedures of treatment facility I. Adjust for second treatment facility.
6. Develop operating procedures for first treatment facility (to be used by others).	75		6. Secure financing for second treatment facility.	•		6. Develop architectural and engineering plans for second treatment facility. (Bidding completed by late 1975).
7. Develop training program for operators of treatment facilities.	•					7. Public information program.
8. Develop public information program.	25					8. Develop program for mandatory separation of papers and containers for southeast region.
9. Secure financing for first facility.	•					9. Work out agreements with border towns from State of New York to use Rutland area treatment facility after 1975.
EVALUATION PROCESS	➡		➡	➡		➡
CONTINGENCY (20% on capital)		15			140	

1975	DEVELOPMENT ($000)	CAPITAL ($000)
Transfer stations serving the northeast region operational by mid 1975.		340
Transfer stations serving regions where temporary disposal agreements are impossible, operational by mid 1975.		200
Transfer station operator training programs.	•	
Aid local units in developing operational and organizational program for private haulers in the Montpelier area.	•	
Develop engineering plans for regional transfer stations serving the Montpelier area. Bidding completed by Fall 1975.	none needed	
Secure financing for addition to existing system. a under assumed locations used for analysis, none to be built.	•	
Regional landfills serving the Montpelier area, operational by early 1975.		
Sanitary landfill operator training program.	•	
Phase out remaining landfills in Northeast region by mid 1975.	•	
Review operating procedures and performance specifications of operating regional landfills – adjust for remaining landfills.	•	
Develop engineering plans for regional landfills serving the southeast region by late 1975.		
Establish input and output requirements for first treatment facility.	20	
Mandatory separation of papers and containers for Montpelier area effective by early 1975. a Materials hauled to Burlington area treatment facility.	•	
Locate site for second treatment facility (Rutland area) serving the southwest region.		5
Review contracts with end users.	•	
Review performance specifications and operating procedures of treatment facility I. Adjust for second treatment facility.	25	
Develop architectural and engineering plans for second treatment facility. (Bidding completed by late 1975).		50
Public information program.	20	
Develop program for mandatory separation of papers and containers for southeast region.	•	
Work out agreements with border towns from State of New York to use Rutland area treatment facility after 1975.	•	
		140

1976	DEVELOPMENT ($000)	CAPITAL ($000)
1. Transfer stations serving the Montpelier area operational by mid 1976.	none needed	
2. Transfer station operator training program.	•	
3. Review operating procedures and performance specifications of operating transfer stations – adjust for remaining transfer stations.	20	
4. New collection procedures effective in the southeast region and Montpelier area by mid 1976.	•	
5. Develop engineering plans for transfer stations serving the southeast region (Bidding completed by late 1976).		60
6. Aid local units in developing operational and organizational program for private haulers in the southeast region by mid 1976.	•	
7. Secure financing for addition to existing system.	•	
1. Regional landfills serving the southeast region operational by mid 1976.		
2. Sanitary landfill operator training program.	•	
3. Phase out remaining landfills in Montpelier area by early 1976.	•	
4. Review operating procedures and performance specifications of operating regional landfills – adjust for final phase of landfill regionalization.	•	
5. Develop engineering plans of remaining regional landfills serving the southeast and northeast regions.		
1. Treatment facility II serving the southwest region, operational by late 1976.		470
2. Mandatory separation of papers and containers effective for southeast region by late 1976.	•	
3. Operator training program for second facility.	•	
4. Public information program.	15	
5. Secure financing for third treatment facility.	•	
		110

1977	DEVELOPMENT ($000)	CAPITAL ($000)
1. Transfer stations serving the southeast region operational by mid 1977.		425
2. Transfer station operator training program.	•	
3. New collection procedures for southeast region effective by early 1977.	•	
4. Review operating procedures and performance specifications of operating transfer stations – adjust for remaining transfer stations.	30	
5. Develop engineering plans for remaining transfer stations (Bidding complete by late 1977).		100
6. Aid local units in developing operational and organizational program for private haulers in remaining part of state.	•	
7. Secure financing for final phase of construction.	•	
1. All regional sanitary landfills operational by late 1977.		
2. Sanitary landfill operator final training program.	•	
3. Phase out remaining landfills in southeast region by mid 1976.	•	
1. Establish input and output requirements for second treatment facility.	20	
2. Locate site for third treatment facility (Springfield area) serving the southeast region.		5
3. Review contracts with end users.	•	
4. Review performance specifications and operating procedures of treatment facilities I and II, adjust for third treatment facility.	25	
5. Develop architectural and engineering plans for third treatment facility. (Bidding completed by late 1977)		50
6. Public information program.	10	
7. Develop program for mandatory separation of papers and containers for southeast region.	•	
8. Secure financing for last treatment facility.	•	
9. Work out agreements with border towns from the State of New Hampshire to use Springfield area treatment facility after 1979.	•	
		120

CAPITAL ($000)	1977	DEVELOPMENT ($000)	CAPITAL ($000)	1978	DEVELOPMENT ($000)	CAPITAL ($000)	1979	DEVELOPMENT ($000)	CAPITAL ($000)
	1. Transfer stations serving the southeast region operational by mid 1977.		425	1. All remaining transfer stations operational by fall 1978.		735			
	2. Transfer station operator training program.	•		2. Transfer station operator training program.	•				
	3. New collection procedures for southeast region effective by early 1977.	•		3. New collection procedures for remaining parts of state effective by mid 1978.	•				
	4. Review operating procedures and performance specifications of operating transfer stations – adjust for remaining transfer stations.	50							
60	5. Develop engineering plans for remaining transfer stations (bidding complete by late 1977).		100						
	6. Aid local units in developing operational and organizational program for private haulers in remaining part of state.	•							
	7. Secure financing for final phase of construction.	•							
	1. All regional sanitary landfills operational by late 1977.			1. All remaining landfills phased out by late 1978.	•				
	2. Sanitary landfill operator final training program.	•							
	3. Phase out remaining landfills in southeast region by mid 1978.	•							
470	1. Establish input and output requirements for second treatment facility.	20		1. Treatment facility III serving the southeast region, operational by fall 1978.		470	1. Establish input and output requirements for third treatment facility.	20	
	2. Locate site for third treatment facility (Springfield area) serving the southeast region.		5	2. Mandatory separation of papers and containers effective for southeast region by fall 1978.	•		2. Treatment facility IV serving the northeast region, operational by fall 1979.		470
	3. Review contracts with end users.	•		3. Operator training program for third facility.	•		3. Mandatory separation of papers and containers effective for northeast region by fall 1979.	•	
	4. Review performance specifications and operating procedures of treatment facilities I and II, adjust for third treatment facility.	25		4. Locate site for last treatment facility (St. Johnsbury area) serving northeast region.		5	4. New operating procedures for Montpelier area operational by fall 1979.	•	
	5. Develop architectural and engineering plans for third treatment facility. (bidding completed by late 1977)		50	5. Review contract with end users.	•		5. Operator training program for last treatment facility.	•	
	6. Public information program.	10		6. Review performance specifications and operating procedures of treatment facilities I, II and III – adjust for last treatment facility.	25		6. Public information program.	5	
	7. Develop program for mandatory separation of papers and containers for southeast region.	•		7. Develop architectural and engineering plans for fourth treatment facility. (bidding completed by late 1978).		50			
	8. Secure financing for last treatment facility.	•		8. Public information program.	10				
	9. Work out agreements with border towns from the State of New Hampshire to use Springfield area treatment facility after 1979.	•		9. Develop program for mandatory separation of papers and containers for northeast region.	•				
				10. Develop program for new operating procedures for Montpelier area – materials will be hauled to treatment facility IV after fall 1979.	5				
				11. Work out agreements with border towns from the State of New Hampshire to use St. Johnsbury area treatment facility after 1979.	•				
			120			250			100

1978	DEVELOPMENT ($000)	CAPITAL ($000)	1979	DEVELOPMENT ($000)	CAPITAL ($000)	1980	DEVELOPMENT ($000)	CAPITAL ($000)
1. All remaining transfer stations operational by fall 1978.		735						
2. Transfer station operator training program.	•							
3. New collection procedures for remaining parts of state effective by mid 1978.	•							
1. All remaining landfills phased out by late 1978.	•							
1. Treatment facility III serving the southeast region, operational by fall 1978.		470	1. Establish input and output requirements for third treatment facility.	20		1. Establish input and output requirements for last treatment facility.	20	
2. Mandatory separation of papers and containers effective for southeast region by fall 1978.	•		2. Treatment facility IV serving the northeast region, operational by fall 1979.		470			
3. Operator training program for third facility.	•		3. Mandatory separation of papers and containers effective for northeast region by fall 1979.	•				
4. Locate site for last treatment facility (St. Johnsbury area) serving northeast region.		5	4. New operating procedures for Montpelier area operational by fall 1979.	•				
5. Review contract with end users.	•		5. Operator training program for last treatment facility.	•				
6. Review performance specifications and operating procedures of treatment facilities I, II and III — adjust for last treatment facility.	25		6. Public information program.	5				
7. Develop architectural and engineering plans for fourth treatment facility. (building completed by late 1979).		50						
8. Public information program.	10							
9. Develop program for mandatory separation of papers and containers for northeast region.	•							
10. Develop program for new operating procedures for Montpelier area — materials will be hauled to treatment facility IV after fall 1979.	5							
11. Work out agreements with border towns from the State of New Hampshire to use St. Johnsbury area treatment facility after 1979.	•							
➡		➡	➡		➡	➡		➡
		250			100			

II. BACKGROUND INFORMATION

Outline of Chapter II

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B. Physical Characteristics	21
C. Population	22
D. Land Use	23
E. Economic Growth	24
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The State of Vermont comprises 14 counties with a total population of 444,732,[28] distributed over 9,609 square miles. The counties perform a limited function, and most of the power and responsibility remain at the level of the 246 towns and municipalities. The State is mountainous with floodplains on the western boundaries. Snow and rainfall vary throughout the State, and a large proportion of its area is covered with snow during the winter months. The transportation network provides easy access to major markets and population centers. Vermont's population is increasing at a slightly faster rate than the national average. The population of the State remains predominantly rural with only 32 percent living in towns, nearly half of whom are concentrated in Chittenden County. It is predicted that economic growth in Vermont will be mainly in the nonmanufacturing sector, most notably in the service and trade sectors. Any growth in the manufacturing sector will be in areas where there is already some concentration of production activity. The resident population of Vermont is highly aware of environmental issues, and steps have already been taken to preserve the State's natural beauty. This chapter describes the major characteristics of Vermont and relates them to its solid waste management requirements.

A. GOVERNMENT — LOCAL AND REGIONAL

Vermont is composed of more than 650 local governmental units[29] within 14 counties. As in most New England states, the counties have very limited responsibilities (mainly judicial) and are greatly dependent upon the State. The budget allocated by the State to each county is very small and does not allow them to provide extensive services.[30] Most of the power remains at the level of the 246 organized cities and town. [31]

Towns in Vermont are governed by Boards of Selectmen, which have both legislative and executive powers. The First Selectman or Chairman has duties similar to those of the mayor of a city. Eight out of the nine cities in Vermont have mayors.[32] Cities and towns have the power to promulgate ordinances. However, floating local bond issues requires the approval of the State's General Assembly.

Despite the fact that State and local laws permit cooperation, the existence of this large number of separate governmental entities discourages regional arrangements. Recently, however, there has been a trend toward multi-town governments. Thirteen regional planning commissions were created by Vermont's Municipal and Regional Planning and Development Act (24 VSA Sub 3, § 4341(a)). Most of these commissions (10 out of 13) are not organized along county lines and vary in size from 6 to nearly 50 towns. One of them also serves towns from another State.[33]

The aim of the Vermont Planning and Development Act was to "constitute a logical geographic and a coherent socio-economic planning area." Despite this legislative intent, not all towns located within the boundaries of regional planning commissions are active participants. The power of these commissions is essentially limited to a planning and advisory function.

In the future it appears that administrative districts will have increasing importance for Vermont. Figure 10, *infra*, page 26, is a map of counties, towns and administrative districts in Vermont. These administrative districts were created by the 1970 session of the State legislature in an effort to reorganize State government into more effective administrative units.[34] Originally only eight, there are presently nine such districts.[35] The State's new management information system and tax reform program rely heavily on these districts. All State agencies and services will eventually be located at one central office in each district.

The boundaries of the district environmental commissions, created in 1971, are coextensive with those of the administrative districts. For solid waste management purposes, it is anticipated that the administrative districts will best achieve economies of scale at the state level for data collection, financial auditing and collecting, enforcement and local support.

B. PHYSICAL CHARACTERISTICS

The State of Vermont covers 9,609 square miles and is the 43rd state of the Union in area.[36] Although it is the only New England state without a coastline on the Atlantic Ocean, most of its boundaries are formed by water. The Connecticut River forms the entire eastern boundary and Lake Champlain marks over 100 miles of boundary on the Western coast.

The State is mountainous, with the Green Mountain Range forming its north-south backbone and a concentration of seven peaks, each over 4,000 feet, on the Canadian border. The low-lying areas of less than 500 feet above sea level are on the western border on the shores of Lake Champlain.[37]

As figure 11, *infra*, page 27, the physical characteristics of Vermont make much of the land unsuitable within acceptable cost for solid waste disposal purposes. The steep slopes of the Green Mountain Range have shallow soils; in some places bedrock is found less than three feet below surface level. These conditions make erosion and runoff likely.

Many of the streams converging in the mountain valleys and eventually in the Connecticut River and Lake Champlain are subject to annual or periodic flooding. EPA proposed guidelines prohibit sanitary landfills in any area which has flooded in the last 50 years — unless a protective system of dykes is included in the design.

The sanitary landfill map (Figure 11, *infra*, page 27) shows the physical limitations which affect disposal on land. Physical limitations indicated on this map are:[38]

- Steep slopes.
- Ability of soils to support building foundations. Soils include swamp soils, alluvial silts, lacustrine silts, organic silts, peat, wet glacial tills (listed as poor to unrecommended for sanitary landfill construction by the EPA).
- Shallow soils — bedrock found less than three feet from the surface.
- Floodplains — prone to annual or periodic flooding.

[28] Vermont *Facts and Figures*, 1971.

[29] *U.S. Census of Governments*, 1967.

[30] The budget for Chittenden County (more than 20 percent of Vermont's population) is less than $50,000 per year.

[31] 237 towns and 9 cities. There are also 5 unorganized towns. The physical pattern of most of the towns is a 6 mile square.

[32] The nine cities are: Burlington, Rutland, Vergennes, St. Albans, Barre, Montpelier, Winooski, Newport and South Burlington, which contemplates charter changes to provide for a mayor instead of a chairman of the city council.

[33] The Upper Valley Planning and Development Council includes the towns of Thetford, Norwich and Hartford in Vermont and other towns in New Hampshire.

[34] The Agency of Environmental Conservation was created the same year.

[35] The Rutland-Bennington region was divided. Administrative districts are in line with Federal requirements.

[36] Bureau of the Census, 1970.

[37] Vermont Central Planning Office.

[38] Figure 11 is an extrapolation of the Vermont Land Capability Plan — 1970.

- Excessive wetness as a result of seasonal high water tables.
- Areas located within watershed supplying surface water supply.
- Permeable soils with high risk of pollution of ground water supplies.

Vermont's climate is similar to that of the other New England States. It is characterized by fickle weather, a large range of temperatures (both daily and annual), great variations between the same seasons in different years and considerable diversity of climate within the state, including inequitable distribution of rainfall. Mean annual precipitation varies from less than 34 inches in the Lake Champlain area and the eastern boundaries to 50 inches in the central southern parts of Bennington and Windham counties. Mean annual snowfall varies from less than 60 inches in the southwestern part of the State to more than 120 inches in the area around Mt. Tabor and Mt. Holly.[39]

Climatic factors have a strong influence on the location, design and method of operation of solid waste disposal sites. The inconsistencies of conditions in Vermont require a system which deals with solid waste disposal on a regional basis.

The transportation network, as shown on Figure 12, *infra* page 28, comprises 14,194 miles of highway of which 2,495 are part of the Vermont State Highways System[40] and 727 miles of main line track operated by 13 different railroads.[41] It is estimated that approximately 90 percent of vehicles using the highways of the State of Vermont are passenger cars; 10 percent are trucks.[42] All but one railroad company operate freight trains only. The Amtrak company carries passengers through the state from the Canadian border to Brattleboro and into Massachusetts.

Vermont is located within a maximum of three hours driving time from three major centers of population: Montreal, Boston and New York.[43] With good road and rail links to these centers, Vermont is within easy range of markets for new products from resource recovery.

C. POPULATION

According to the U.S. Census of 1970, Vermont, with a population of 444,732, ranked 48th in number of inhabitants. However, the State covers a relatively small area and ranked 22nd in terms of population density.

In the past decade Vermont's population has increased by 14.1 percent, a figure higher than the growth rates for New England (12.7 percent) and for the nation as a whole (13.3 percent).[44] The Vermont State Planning Office expects the population to have reached 497,800 by 1980. Figure 13, *infra* or *supra*, page 23, illustrates the population distribution and the projected urban development patterns.

Between 1950 and 1960 emigration was greater than immigration. This pattern changed in the 1960's, and 28 percent of population growth in the years 1960 to 1970 can be attributed to net immigration.[45]

Population density varies widely throughout the State. Some urban areas, such as Burlington and Rutland, have population densities as high as 252 people per square mile, but outside these towns Vermont is populated at low density.

The State's population is predominantly rural and likely to become more so. While the Census of 1970 showed that the urban population in the U.S. as a whole had increased from 69 percent to 73.5 percent over the last ten years, urban population in Vermont had decreased from 38.5 percent to 32.1 percent of the total.

Table 12 indicates urban versus rural population by county in 1970. Nearly half the urban population of the State is concentrated in Chittenden County; Washington and Rutland counties are also predominantly urban. Six counties have a totally rural population. According to the Vermont State Planning Office, Chittenden County is expected to lead the State in rate of population growth through 1980, but at a slightly lower rate than in the ten years 1960-1970. Rutland County, Lamoille, Grand Isle and Bennington will follow. The northeast counties of Orleans and Caledonia are projected to develop at a faster

Table 12

URBAN AND RURAL POPULATION BY COUNTY

1970

COUNTY	URBAN POPULATION	RURAL POPULATION	TOTAL POPULATION
Addison	—	24,266	24,266
Bennington	7,950	21,332	29,282
Caledonia	—	22,789	22,789
Chittenden	60,420	38,711	99,131
Essex	—	5,416	5,416
Franklin	10,712	20,570	31,282
Grand Isle	—	3,574	3,574
Lamoille	—	13,309	13,309
Orange	—	17,676	17,676
Orleans	4,664	15,489	20,153
Rutland	19,293	33,344	52,637
Washington	21,658	26,001	47,659
Windham	12,560	20,916	33,476
Windsor	5,632	38,450	44,082
Total	142,889	301,843	444,732

Source: *Vermont Facts and Figures*, 1971.

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[39] Vermont Central Planning Office.

[40] As of March 31, 1972. Vermont Department of Highways, Highways Planning Division.

[41] As of December 31, 1972. Vermont Department of Public Services.

[42] As of March 15, 1972, Vermont Department of Highways, Highways Planning Division.

[43] Montreal: 2.6 million. Canadian Census of 1966, updated 1970.
Boston: 2.8 million.
New York: 7.9 million in the five boroughs alone and an additional 3.6 million in the suburbs within the metropolitan area. Bureau of the Census, 1970.

[44] *Vermont Social and Economic Characteristics*, 1971.

[45] *Vermont Facts and Figures*, 1971.

Table 13
SUMMARY OF LAND USE—1962

Use	Acres	%	Notes
Forests	4,085,590	66.3	(includes pastured woodlands, state and national forests and parks)
Agricultural	1,468,542	23.8	(open farm land)
Water & marshes	322,297	5.2	
Highways	127,768	2.1	
Vacant land	67,042	1.1	(mountains, rocks)
Urban	48,038	0.8	
All other	43,531	0.7	(railroad facilities, utilities, etc.)

Source: Vermont Interim Land Capability Plan 1972.

rate upon completion of interstate highways in the mid-seventies. The southern counties of Bennington and Windham will continue to grow as urban families demand vacation or retirement homes.[46]

During 1971-1972 the population in Vermont was temporarily increased by over 6 million visitors, more than 13 times the total population. These included skiers, summer campers, hotel guests, and owners and renters of vacation homes. One third of these tourists came during the winter; the remaining two thirds visited mainly in the summer and fall.

The population characteristics outlined above must be taken into account when designing an appropriate solid waste management system. Variations in population density mean that the system will have to provide for collection from remote and scattered areas as well as from areas of urban concentration. This indicates the desirability of a regional approach. Although the population of Vermont is not expected to become more urbanized, those people who migrate from cities into the Vermont countryside will retain some elements of their urban life-style, and the composition of rural waste will change. This underlines the need for a flexible system of solid waste management which can take account not only of population growth, but also of shifts in the composition of the waste stream.

D. LAND USE

Vermont's Act 250, the State's development control law, was passed in 1970. The Land Capability Plan, which assesses the ability of the soil to support development and the Land Use Plan, which designates general areas where development should take place, were published in the fall of 1972. Table 13 gives a summary of land use in Vermont in 1962; these proportions have not changed significantly since then. Vermont's land use policy relates to solid waste management in the following areas: maintain quality of environment; maintain rural nature of state; develop infra structure in optimum way and minimize new demands on public utilities, resources and energy; encourage efficient use and where possible reuse of limited resources ("*Encouragement will be given to approaches to waste management that make possible the recovery of reusable materials or processing of wastes so that they can be safely assimilated into the environment without pollution of air, water or soil.*")[47] This policy is characterized by a desire to conserve the natural benefits of the State, rather than to encourage "progress" and industrial development at the expense of the environment.

Under the Land Use Plan, all land in Vermont is assigned to one of five categories: 1. urban district, 2. rural residential, 3. agricultural conservation, 4. resource and agricultural conservation, and 5. reserve lands. It is not expected that development will take place outside categories 1 and 2. It is the policy of the State of Vermont that development of land in categories 3, 4 and 5 will not be permitted unless it can be proved that the benefit to the public clearly outweighs the resource value of conserving the land.

One of the effects of the Land Use Plan on solid waste management will be that it will be possible to predict the use to which land in a given area will be restricted and therefore to estimate the volume and composition of the solid waste stream which the area will produce.

Section III-E of the Vermont Capability and Development Plan deals directly with Solid Waste Management and is quoted in full below:

E. Waste Disposal

1. Environmental Impact of Solid Waste Disposal —
   In order to maintain a high quality water, land and air resource for the people of the state and its visitors, it is the policy of the State of Vermont that future solid waste disposal programs and facilities shall be designed and existing programs and facilities modified to minimize the likelihood of contamination of the ground and surface waters, land, and air.
2. Recovery of Reusable Materials —
   In order to maintain the maximum possible benefit from the limited natural resources of the state and nation, it is the policy of the State of Vermont that the planning and design of future solid waste disposal programs and facilities shall, to the extent feasible and reasonable, provide for the recovery of reusable materials.
3. Programs for Handling Unique Solid Waste Problems —
   Some types of development generate unique or large amounts of wastes which cannot be disposed of economically or without adverse effects on the environment. It is the policy of the State of Vermont to permit development responsible for unique or large amounts of wastes only if it can be demonstrated that a method is available that will allow the environment to assimilate the wastes satisfactorily or the public to finance the method without assuming an unreasonable economic burden. A method of disposal shall not be considered acceptable if it transfers the wastes outside the state and imposes the problem upon another state or on the United States.
4. Deep Well Waste Disposal —
   Maintaining high quality water in the state, including waters beneath the ground's surface, is essential to the health and well-being of Vermont's citizens and the continued strength of the Vermont economy. The precise movement of pollutants within ground water is difficult to predict due to incomplete knowledge of surficial and bedrock geology and related factors.

   It is the policy of the State of Vermont that the discharge or injection of water materials into wells shall not be adopted as a means of waste disposal.

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[46] *Vermont Social and Economic Characteristics*, 1971.

[47] *Vermont Land Use Plan*, 1972.

Table 14

PROJECTIONS OF EMPLOYMENT TO 1980

Type of Employment	Employment		Average Annual Rate of Change (%)
	Actual 1970	Projected 1980	
Durable Goods	27,200	31,500	+1.5
Non-Durable Goods	13,400	14,700	+0.9
Non-Manufacturing	140,200	174,200	+2.2

Source: 1970 Data, Department of Employment Security, State of Vermont.

E. ECONOMIC GROWTH[49]

Table 14 presents employment by broad industry sector in 1970 and projected to 1980. It indicates that economic growth will take place mainly in the non-manufacturing sector.

In the durable goods sector, industries with a projected decline in employment are lumber and wood, stone, clay and glass. Employment in the manufacture of machinery is expected to fluctuate around the present level. Steady growth is expected in furniture and fixtures, and employment in electrical machinery will grow at approximately 2.4 percent per annum, provided that economic conditions are favorable. In the non-durable goods sector, slow growth or decline is predicted in all industries except printing and publishing.

In non-manufacturing employment, the fastest growing sectors are service employment, State and local government and wholesale and retail trade. Slow growth is predicted in contract construction, transportation and public utilities. It is predicted that the numbers employed in mining and quarrying will remain steady, while those in agriculture will decline at 2.6 percent per annum, from 16,500 in 1970 to 12,500 in 1980.

The implications of these predictions for solid waste disposal are:

- Increased solid waste will be of a domestic or commercial, rather than an industrial, type. Tourist waste will increase in volume.
- Solid waste from mining operations will not increase greatly, nor will the nature of the minerals extracted change unless large scale excavation of copper results from prospecting now taking place in the Strafford area.
- Agricultural waste will not decline in volume as output per man-hour will rise to meet the decline in employment.

Growth in industry is expected to take place mainly in areas which already have a concentration of manufacturing activity (See Figure 14, *infra*, page 30)). Areas in which the Agency of Development and Community Affairs may use its powers to promote industrial development include Franklin County and the area between Newport and Jay (Orleans County) where unemployment is chronic.

The Agency of Development and Community Affairs has the power to erect shell buildings and sell them to manufacturers in order to promote industry in certain areas. Such buildings have already been erected in Bradford, St. Johnsbury and southeast of Newport, and further development is possible in St. Albans, Springfield (or Bellows Falls) and Middlebury.

In general, however, increase in industrial activity (and therefore in industrial solid waste) should be expected in the areas where industry is already established.

F. LOCAL TAXES[50]

Local taxes are collected by Vermont's 246 towns. Each imposes a tax based on the assessed value of real property and personal property (e.g., stocks of retailers). The following Table 15 lists examples of tax changes in three selected cities over the five years 1967-1972.

City representatives meet every year and decide on a budget. Taxes are then fixed at a percentage rate on the assessment of real and personal property. Where the tax dollar requirement exceeds the pro rata increase provided by increased values, the percentage rate of taxes is raised to meet it; where the requirement is less than the rate previously levied, taxes are lowered. In some cities, e.g. Burlington, voters endorse tax raises only up to a ceiling and any raise above this amount must be referred back to them.

Table 15

EXAMPLES OF TAX CHANGES 1967–1972

Brattleboro		Pop. 1972: 12,239
	1% of total evaluation	Rate of tax charged
1967	$288,145	7.14%
1972	$380,438	10.10%
Burlington		Pop. 1972: 38,633
	1% of total evaluation	Rate of tax charged
1967	$525,000 (approx.)	9.68%
1972	$586,000 (approx.)	10.04%
St. Albans		Pop. 1972: 8,082
	1% of total evaluation	Rate of tax charged
1967	$136,500	6.54%
1972	$172,000 (approx.)	8.91%

Source: Personal communication with City Treasurers.

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[49] *Vermont Social and Economic Characteristics*, 1971.

[50] Note: These comments do not refer to school taxes.

Because of the number and diversity of the authorities who levy local taxes, it is difficult to make any general statement as to their capacity to participate in the funding of a solid waste management scheme.

G. PUBLIC AWARENESS

The residents of Vermont have demonstrated that they are unusually aware of their environment. A survey conducted by the Vermont Natural Resources Council[51] indicates that Vermonters would like to be better informed about matters of environmental concern and that they are willing to pay in order to improve their environment. Act 250 is one of the most advanced pieces of environmental legislation to date. Despite the economic importance of the tourist industry, it will be regulated; Vermont is tightening up on the location and organization of ski resorts, camp sites and other leisure areas.

For several years volunteer groups all over the State have been organizing recycling activities. Voluntary environmental action has received State support for an annual "Green Up" day since 1970. In that year activities involved approximately 80,000 inhabitants who cleared the Vermont highways of litter. A survey released in December 1972 conducted by Vermont's Environmental Planning Information Center (EPIC) revealed that 64 percent of the random group surveyed support the establishment of a recycling program, even if it costs more. Only 30 percent felt that the existing landfill system should be continued. This greatly facilitates implementation of a solid waste management program, which is dependent for its success on public participation. (See supra, page 11.)

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[51] Vermont Natural Resources Council, *An Environmental / Economic Profile of Vermont by Vermonters*, January 1972.

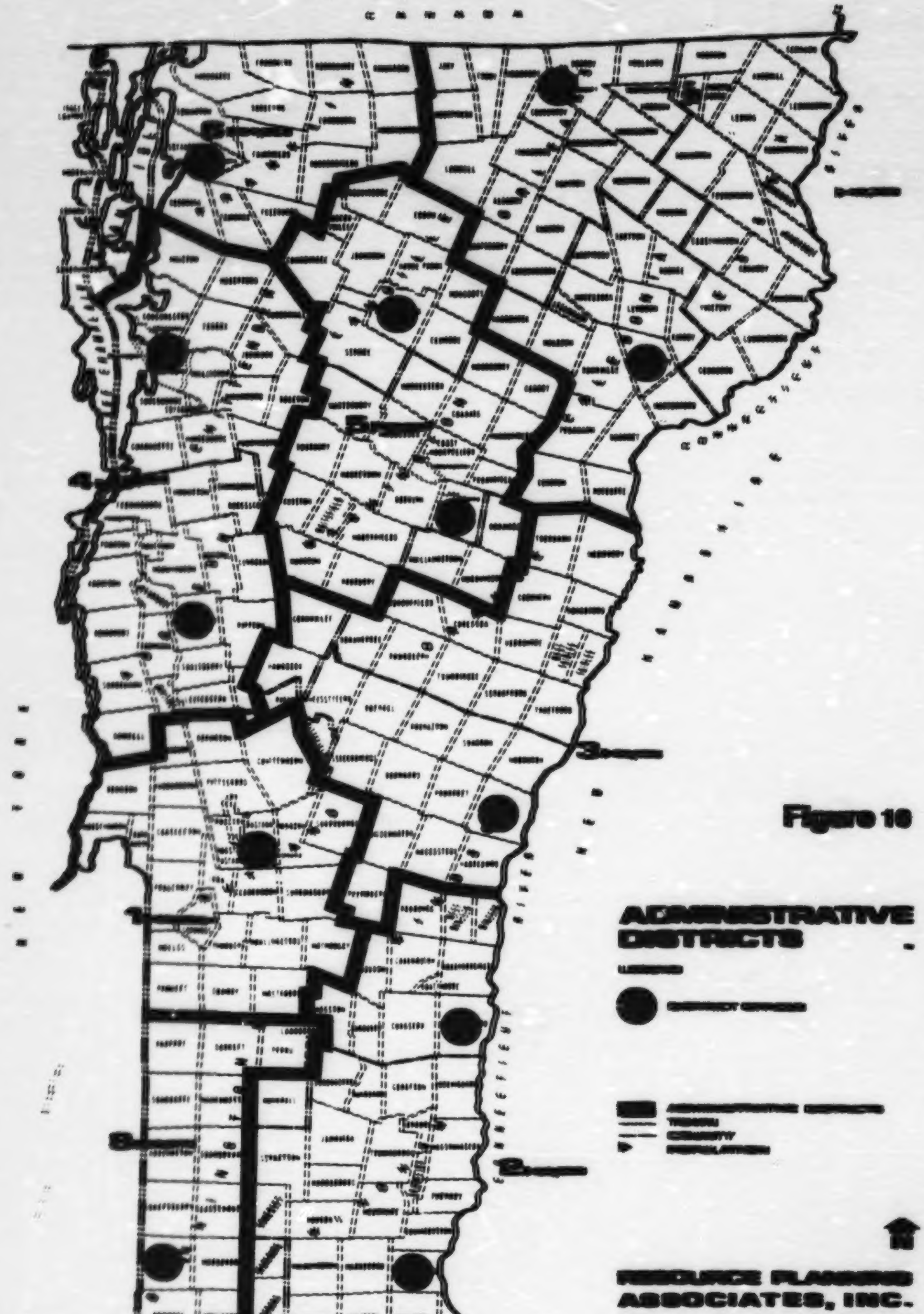

CANADA
MASSACHUSETTS
NEW YORK
NEW HAMPSHIRE
CONNECTICUT RIVER
1
2
3
4
5
6
8
LEGEND
DISTRICT OFFICES
ADMINISTRATIVE DISTRICTS
TOWN
COUNTY
POPULATION
N
RESOURCE PLANNING
ASSOCIATES, INC.
0
5
10

Figure 16

ADMINISTRATIVE DISTRICTS

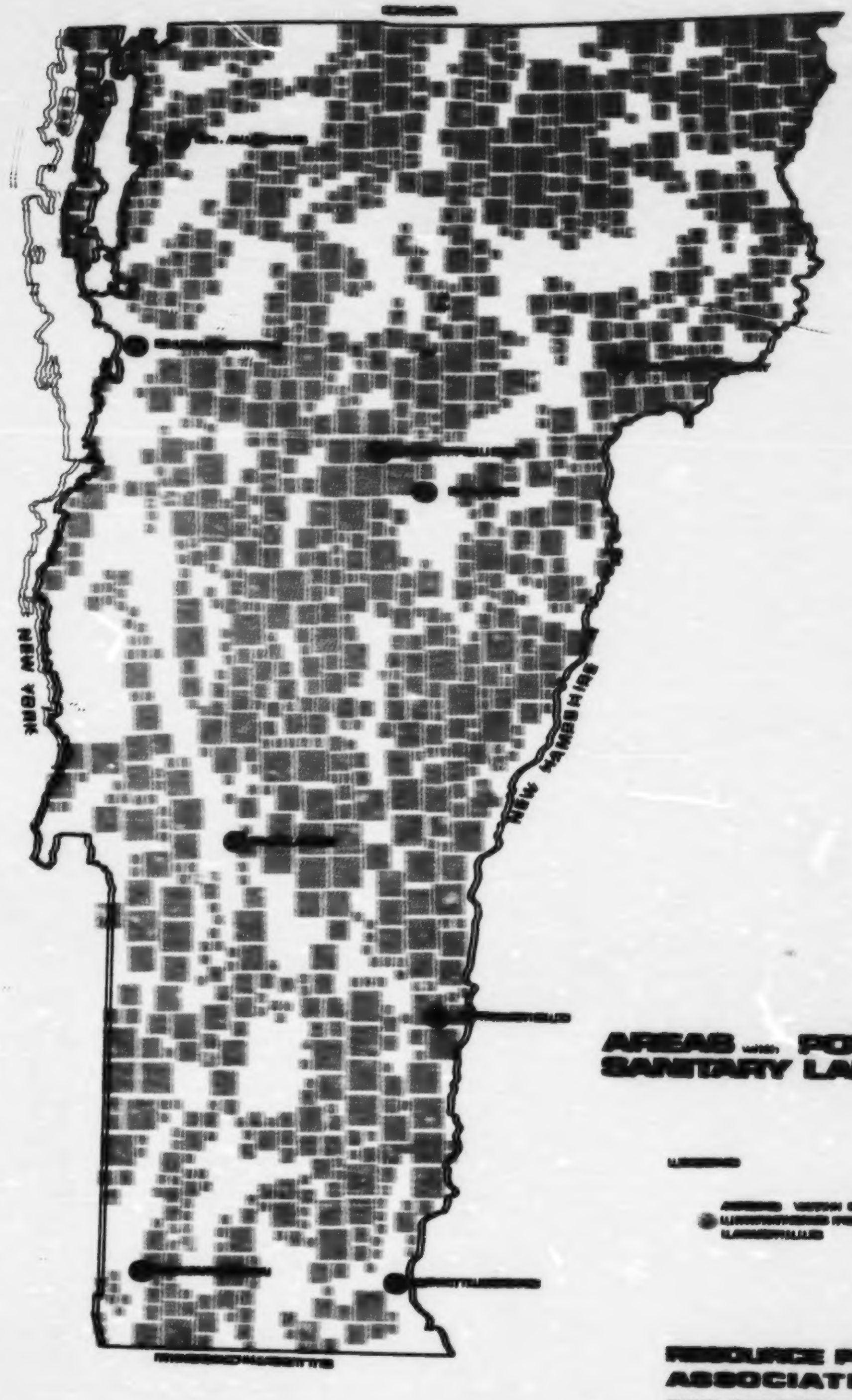

CANADA
NEW YORK
NEW HAMPSHIRE
MASSACHUSETTS

Figure 11

AREAS with POTENTIAL SANITARY LANDFILLS

LEGEND
[illegible]
N

RESOURCE PLANNING ASSOCIATES, INC.

0 5 10 Miles
JANUARY [illegible]

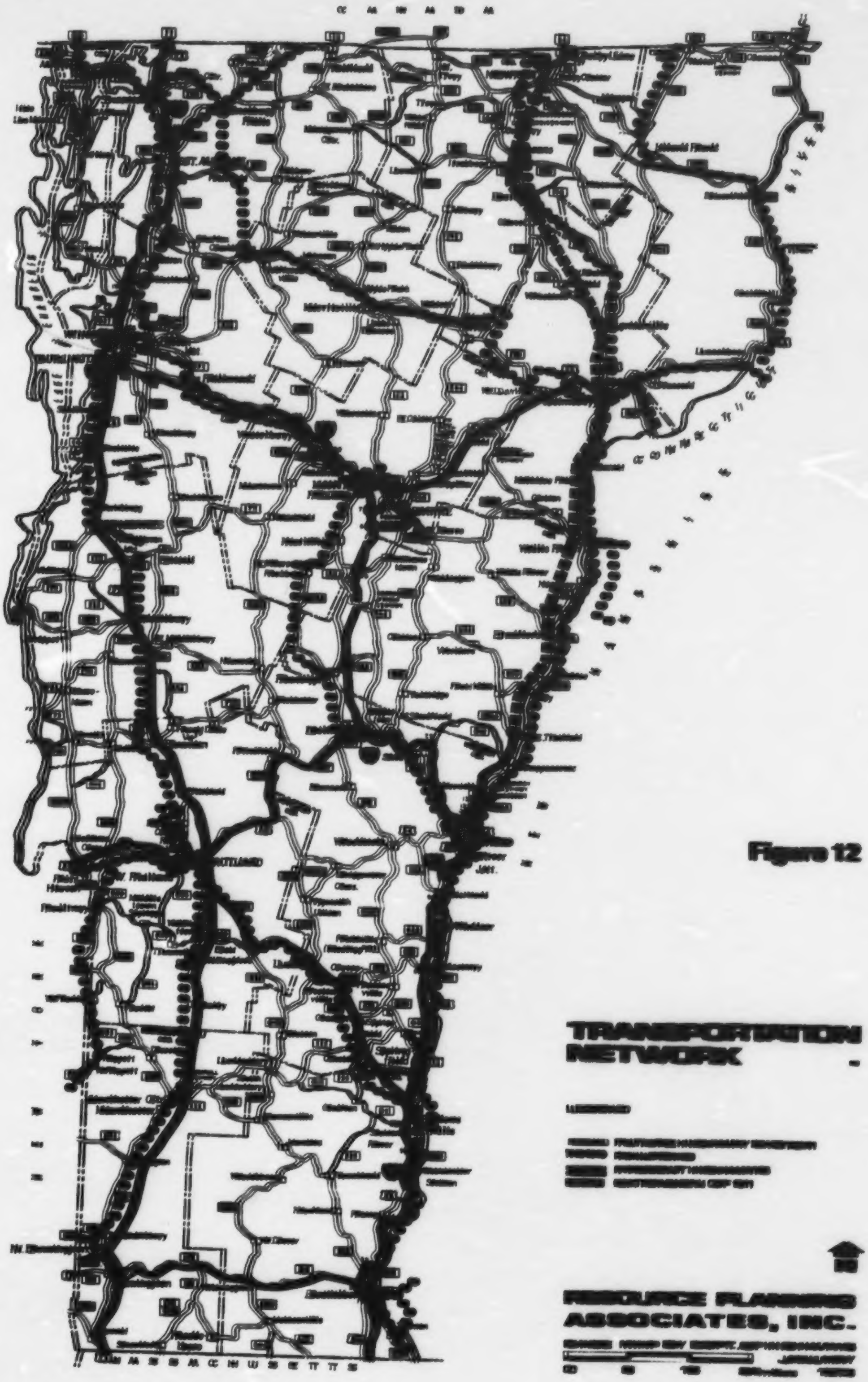


Figure 12

C A N A D A
N E W Y O R K
M A S S A C H U S E T T S
N E W H A M P S H I R E
C O N N E C T I C U T
R I V E R
RUTLAND
TRANSPORTATION NETWORK
LEGEND
[illegible]
[illegible]
[illegible]
[illegible]
N
RESOURCE PLANNING ASSOCIATES, INC.
BASE MAP BY DEPT. OF HIGHWAYS
JANUARY
0 5 10 Miles
[illegible]

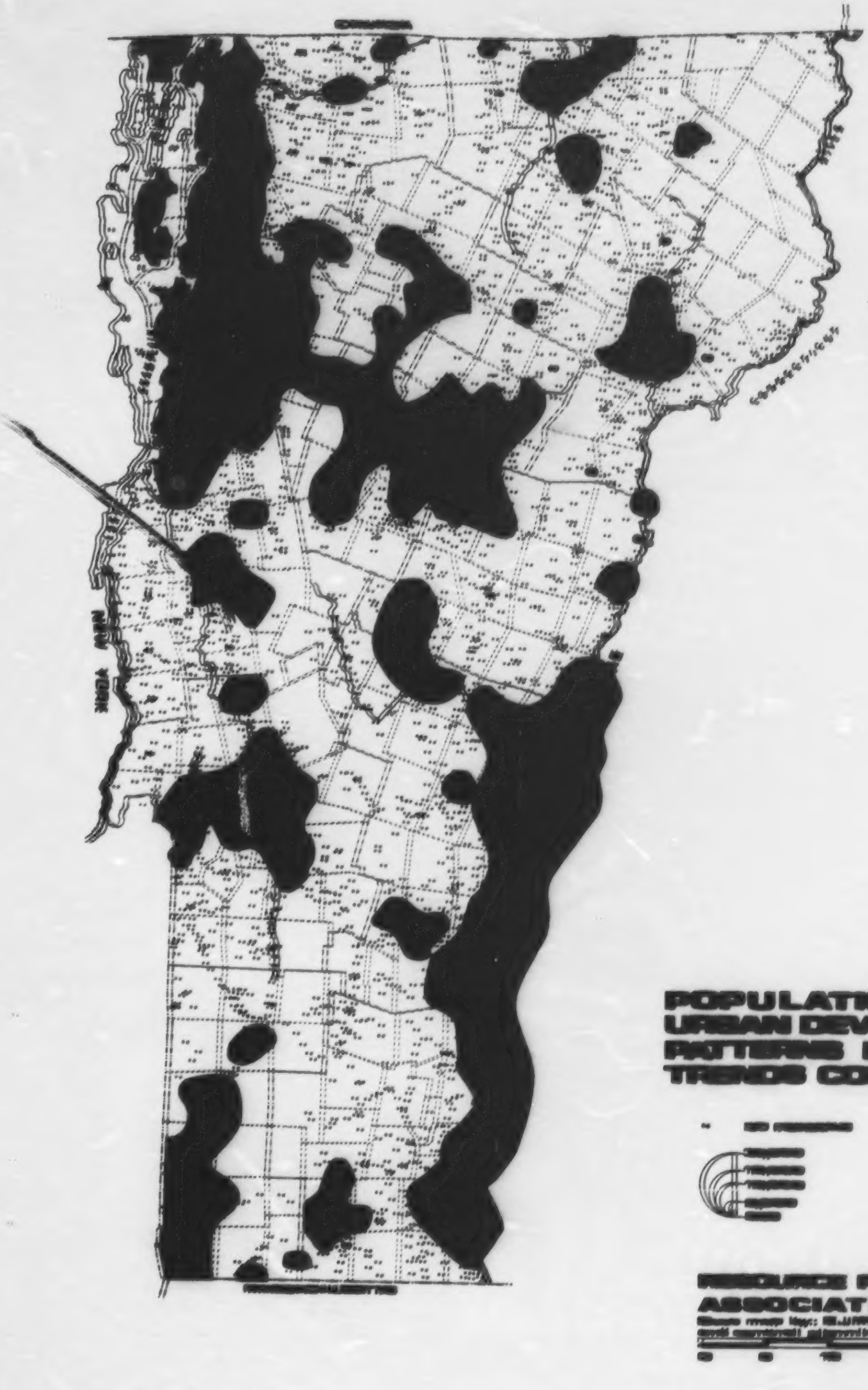

CANADA
NEW YORK
MASSACHUSETTS

Figure 13

POPULATION AND URBAN DEVELOPMENT PATTERNS IF PRESENT TRENDS CONTINUE 1990

RESOURCE PLANNING ASSOCIATES, INC.

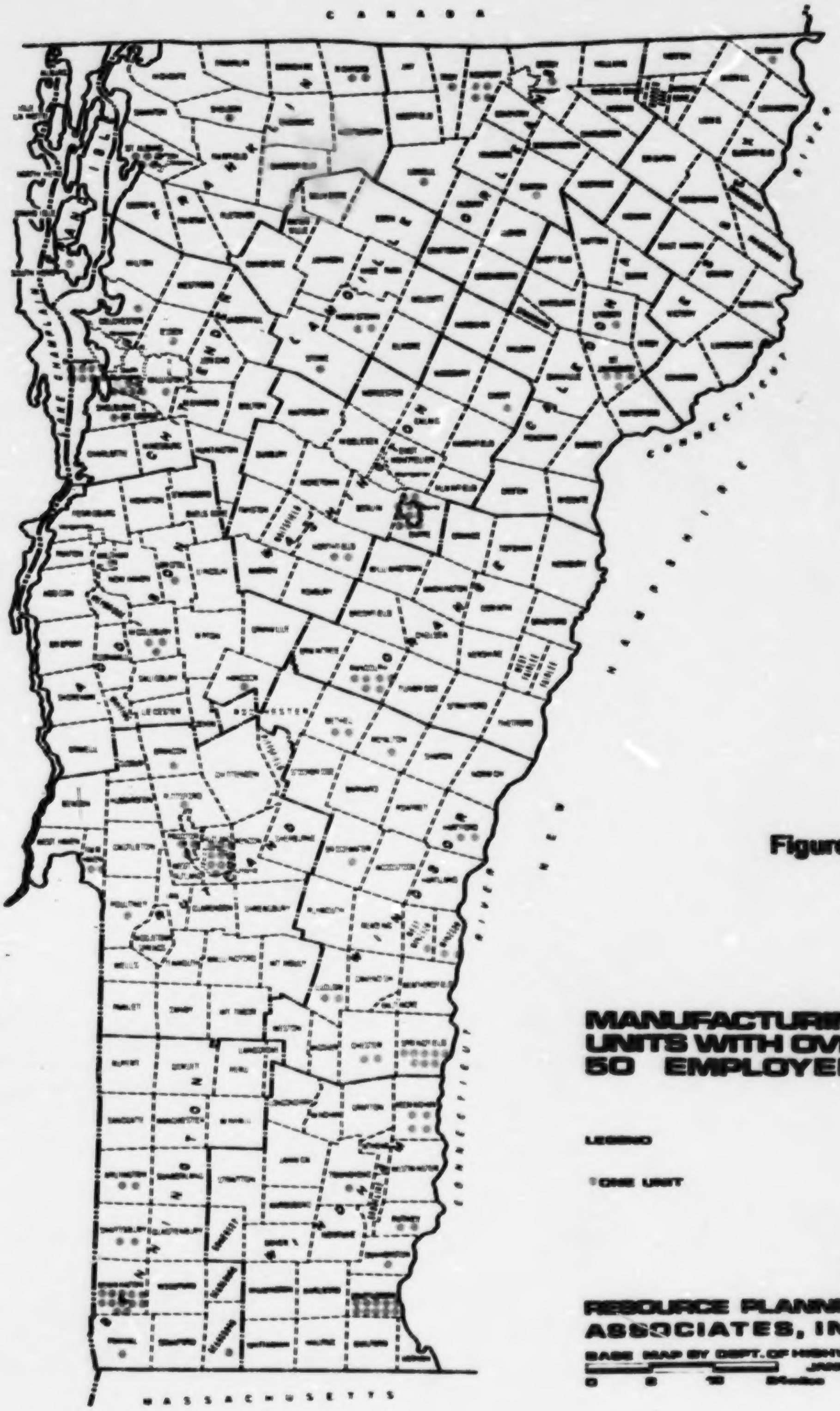

CANADA
NEW YORK
LAKE CHAMPLAIN
NEW HAMPSHIRE
CONNECTICUT RIVER
MASSACHUSETTS

Figure 14

MANUFACTURING UNITS WITH OVER 50 EMPLOYEES

LEGEND

● ONE UNIT

N

RESOURCE PLANNING ASSOCIATES, INC.

BASE MAP BY DEPT. OF HIGHWAYS
JANUARY
0 5 10 20 miles [illegible]

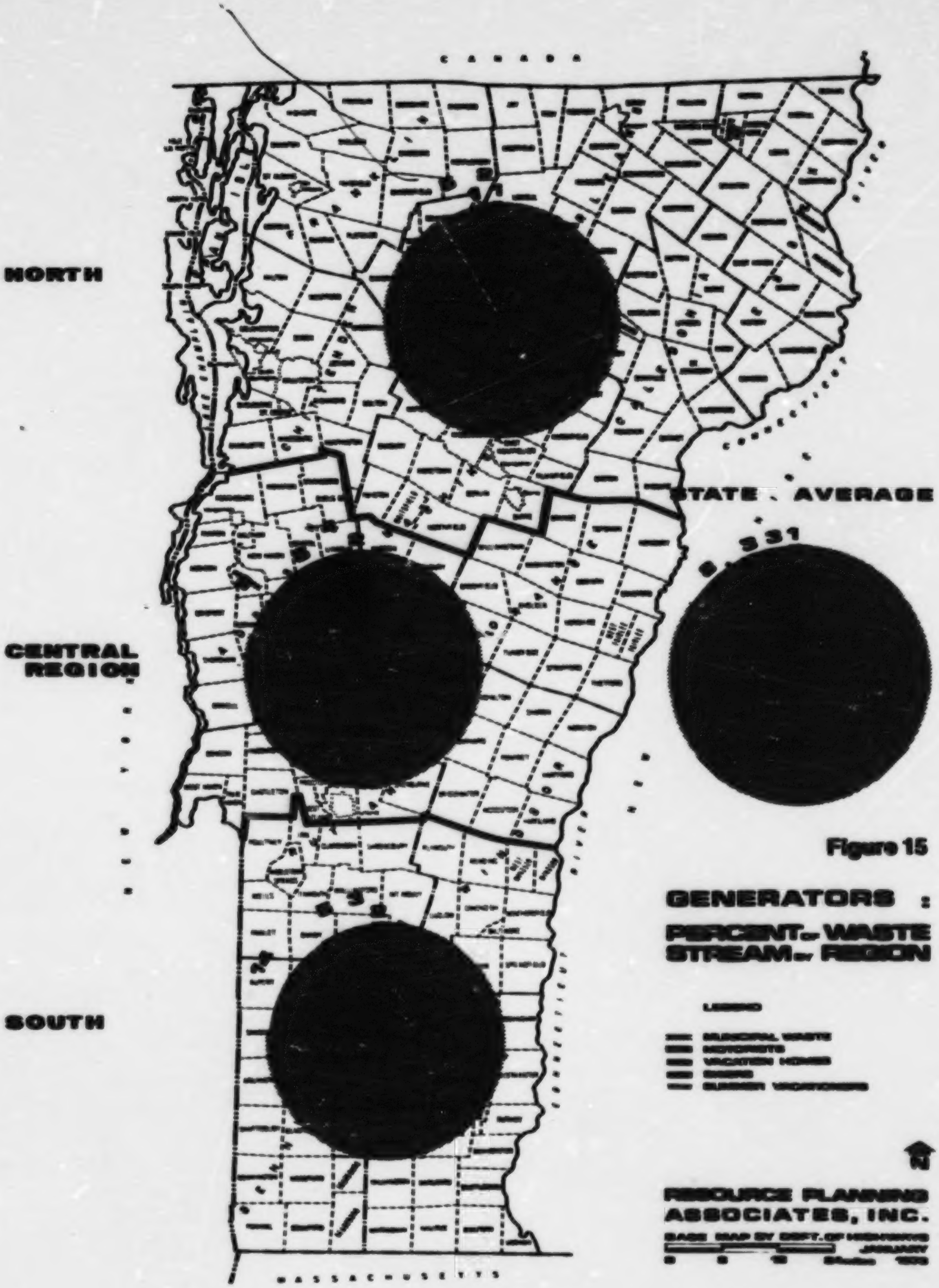

CANADA
NORTH
CENTRAL REGION
SOUTH
STATE AVERAGE
MASSACHUSETTS
NEW YORK
CONNECTICUT RIVER
LEGEND
MUNICIPAL WASTE
MOTORISTS
VACATION HOMES
SKIERS
SUMMER VACATIONERS
N
RESOURCE PLANNING ASSOCIATES, INC.
BASE MAP BY DEPT. OF HIGHWAYS
JANUARY
0 5 10 Miles

Figure 15

GENERATORS: PERCENT OF WASTE STREAM BY REGION

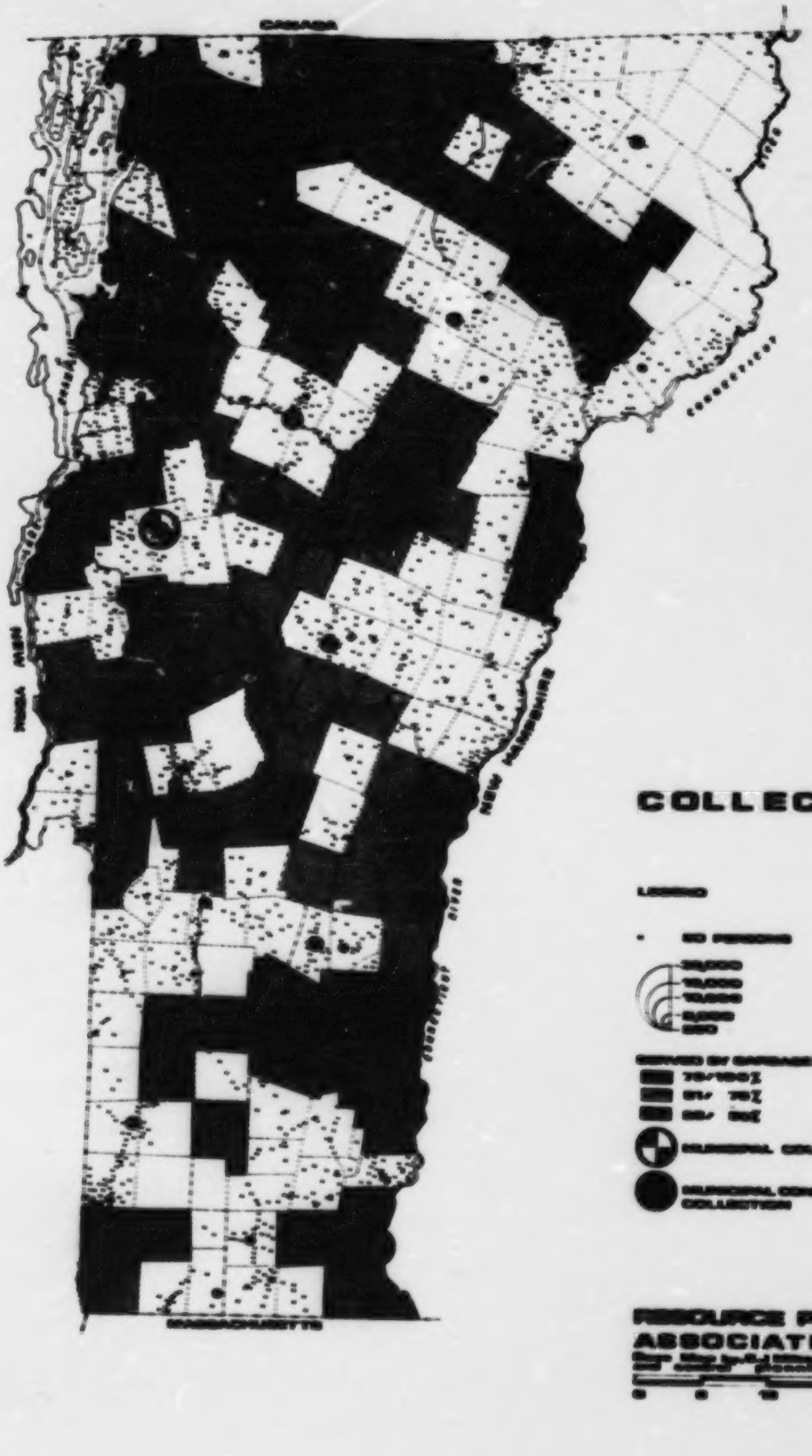

CANADA
NEW YORK
NEW HAMPSHIRE
CONNECTICUT RIVER
MASSACHUSETTS

Figure 16

COLLECTION

LEGEND
• 50 PERSONS
20,000
15,000
10,000
5,000
500
SERVED BY GARBAGE COLLECTION
75-100%
51- 75%
26- 50%
MUNICIPAL COLLECTION
MUNICIPAL CONTRACT COLLECTION
N
RESOURCE PLANNING
ASSOCIATES, INC.
JANUARY
1975

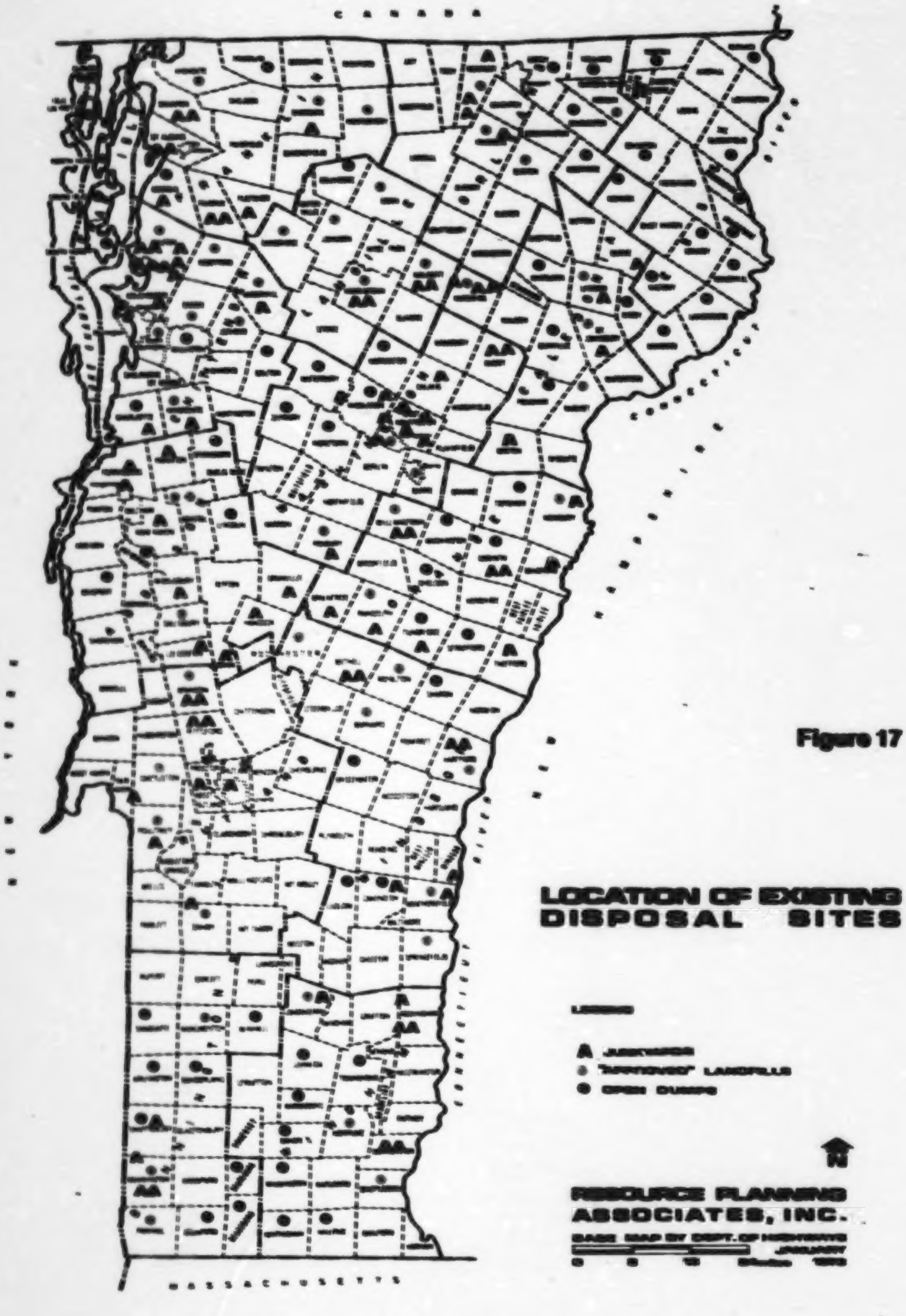
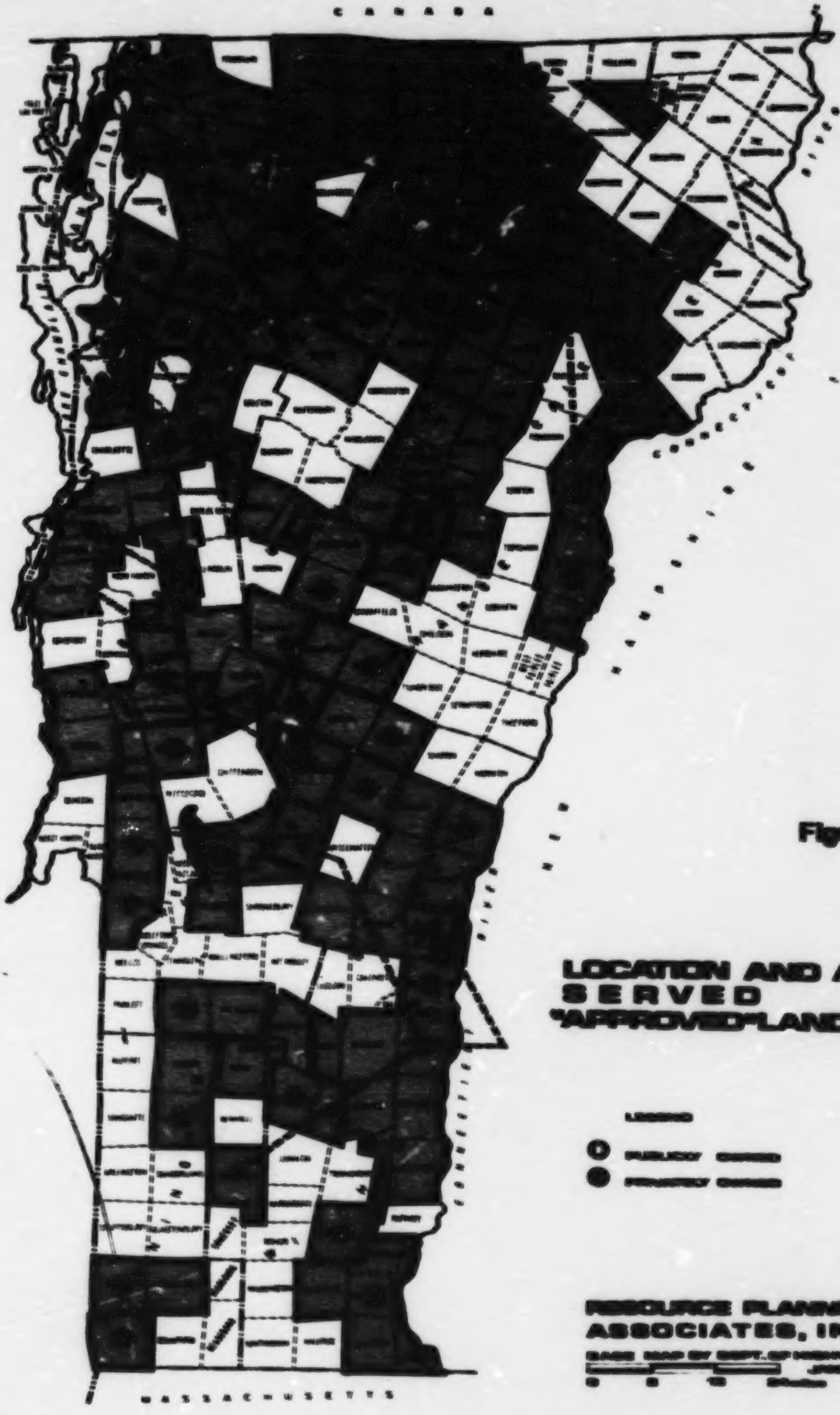

CANADA
MASSACHUSETTS
CONNECTICUT RIVER
LAKE CHAMPLAIN
LEGEND
JUNKYARDS
"APPROVED" LANDFILLS
OPEN DUMPS
N
RESOURCE PLANNING
ASSOCIATES, INC.
BASE MAP BY DEPT. OF HIGHWAYS
JANUARY
0 5 10 Miles [illegible]

Figure 17

LOCATION OF EXISTING DISPOSAL SITES

Figure 18


CANADA
NEW YORK
NEW HAMPSHIRE
CONNECTICUT RIVER
MASSACHUSETTS

LOCATION AND AREA SERVED BY "APPROVED" LANDFILLS

LEGEND

○ PUBLICLY OWNED
● PRIVATELY OWNED

N

RESOURCE PLANNING ASSOCIATES, INC.

BASE MAP BY DEPT. OF HIGHWAYS
JANUARY
0 5 10 Miles [illegible]

III. PRESENT STATUS OF SOLID WASTE MANAGEMENT IN VERMONT

Outline of Chapter III

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Most of the data on volume and composition of the municipal waste stream were estimated by relating land uses and population distribution to generation coefficients. These "coefficients" were based on surveys,[52] and Resource Planning Associates' previous studies in solid waste. The population was divided into four categories[53] for which generation and composition coefficients were formulated: rural population, urban population, winter tourist and summer tourist. The major portion of the background information on the current solid waste practices in collection, disposal and resource recovery were derived from existing State and regional studies, interviews, field trips and mailed surveys.

A. SOLID WASTE GENERATION

Outline of Section A

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1. Summary

Resource Planning Associates estimates that the total municipal waste stream currently being disposed of on Vermont's land amounts to 313,000 tons per year, or 3.85 pounds per day per capita. Table 16 shows the breakdown in tons by sector of the municipal waste stream and Table 17 the component breakdown on a state average.

Each sector presents particular problems requiring special attention. Types of waste and disposal practices vary and must be considered individually. In agriculture, for example, the total amount of waste generated is large; however, the quantities of agricultural wastes actually reaching disposal sites are negligible. Since no sector generates the same type of waste, the individual variables of each sector must be considered in order to develop a comprehensive plan for the entire State.

Table 16

MUNICIPAL WASTE STREAM BY SECTOR

Sector	1000 Tons per year	Pounds per Capita per day
Residential and Commercial	230	2.8
Tourism	45	.6
Institutional	3	.05
Industrial	35	.4
Agricultural[1]	–	–
	313	3.85

[1] Agricultural waste is one area with close to 100 percent recycling, see infra, page 37.

Table 17

MUNICIPAL WASTE STREAM COMPONENTS[1]

Percentages by Weight

Components		Percent
Paper		42.
Cardboard	7.	
Newsprint	12.	
Low Quality Mixed	16.	
High Quality Mixed	7.	
Metal		9.
Glass		10.
Organics		24.
Other		15.
		100.

[1] State average.

Table 18

INSTITUTIONAL WASTE — MAJOR AREAS OF GENERATION

The following areas defined by town boundaries generate more than 200 pounds of institutional waste per day.

Bennington
Berlin
Brandon
Corinth
Coventry
East Montpelier
Fairfield/Enosburg
Johnson/Hyde Park
Lyndon
Pittsford

Richmond/Williston
Rockingham
Rutland
South Burlington
Sunderland
Vergennes
Waterbury
Weybridge
Windsor
Woodstock

Source: *State of Vermont Solid Waste Disposal Study for Institutions*, Department of Administration, State Building Division, August, 1970.

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[52] The total amount of solid waste that is generated in Chittenden County (25 percent of Vermont's population) and disposed of on land has been measured at the twelve disposal sites in the county. This survey was part of a project conducted by Trans/OP Inc., for the Chittenden County Regional Planning Commission, during the second part of 1972. Manual classification counts were actually taken over a period of several days. Trans/OP estimates that the production rates for the rural communities are less than 3 pounds per capita per day, and for more urban and industrial areas vary from 3.4 to 5.7 pounds. The average for Chittenden County is estimated at 4 pounds per day and per capita.

[53] In reality a more complex model was used. For instance, winter tourists were further divided into skiers and others, and summer tourists into vacation home owners, campers and motorists.

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2. Generation by Sector

Residential and Commercial. This classification includes all waste coming from private homes and retail businesses[54] which accounts for 74 percent of the waste stream (230,000 tons per year). Residential waste may be further divided into urban and rural. ("Urban" includes all areas with more than 2,000 inhabitants.) The difference in per capital generation of 4 pounds per day for urban and 3 pounds per day for rural can be explained by differences in life style between city and country. Shopping centers, newspapers, magazines and prepackaging all contribute to a higher urban waste figure.[55] Urban-rural differences in per capita waste generation are becoming less marked.[56]

Institutions. Waste generated by institutions[57] contributes only one percent of the total waste stream and will have little impact on the Plan. However, special attention to this problem must be given at the local level. In each area where a large complex exists, adequate provisions must be made for storage, collection and disposal. Institutional waste will be of local importance in the areas indicated in Table 18.

National and state studies indicate that institutions contribute approximately 4.2 pounds per day per person and hospitals add an average of 4.19 pounds per day per bed to the total waste stream.[58] Even though the total amount of institutional waste is small, it can have significant effects on local disposal sites.[59]

Manufacturing Industry. Thirty-five percent of the total working force in Vermont, as compared to the national average of 27 percent, are employed by the manufacturing industry.[60] The manufacturing industry produces only 14 percent of the waste reaching disposal sites.[61] Total industrial waste is much higher, but a large percentage is diverted from the municipal waste stream. The wood industry is a good example. Twenty-five percent of Vermont's manufacturing units are wood-related.[62] These include saw and paper mills, furniture factories, etc. Total wood residue for the State is close to 337,500 tons per year, but virtually none of it is landfilled.[63] Waste wood, after it goes through a hogging process which reduces it to fairly uniform pieces, is used as fuel by the mills themselves or as animal bedding by the dairy industry.

Agriculture. Sixty-one point five percent of Vermont's population is classified as rural, and agriculture accounts for five percent of the Gross State Product.[64] Although large quantities of agricultural wastes are generated, rural Vermonters have been recycling their own agricultural wastes for many years, so there is little impact on the municipal waste stream.[65]

Vermont ranks 10th in the nation in milk production. Over 4,000 commercial dairies produce most of the agricultural wastes. Collectively, these farms produce 3,000,000 tons per year of fresh cow manure. Most dairy farmers grow their own corn, and therefore can use the manure as fertilizer on their own land.

The poultry industry, on the other hand, must depend on outside sources for disposal of its waste. Vermont's poultry industry (over 800,000 laying hens) produces 47,000 tons of waste per year. Most poultry men do not own their crop land, and their best disposal source is the dairy farmer. Combined with cow manure, poultry waste becomes excellent fertilizer. Other types of agricultural waste (cider pressings, syrup residue, etc.) do not pose serious management problems.[66]

3. Seasonality Factors — Tourism

Vermont had over 6 million visitors in 1971-1972. Since this is thirteen times the number of residents in the State, the seasonal portion of the waste stream will be an important factor in Vermont's solid waste management plan. While Vermont is renowned for its skiing, hosting one million skiers per year, more than four times this number visit the State in the summer and fall.[67]

The impact of tourism on the municipal waste stream varies throughout the State. (See Figure 15, *infra*, page 31.) On the average, 15 percent of the State's waste is generated by tourists.[68] However, this figure may be as low as 9 percent in the northern region.[69] In contrast, Windham and Bennington counties in the central and southern regions of the State have large transient populations which contribute close to 24 percent of their entire waste stream. Several large ski areas, State parks, private camping areas, and easy accessibility make this part of the State very attractive to visitors from nearby Connecticut, Massachusetts and New York.

In some areas, tourist-generated waste may double the municipal stream during certain periods of the year. For example, in southern Vermont tourists contribute a yearly average of 24 percent of the waste stream. This figure increases to 47 percent during the summer, and, for the month of August, to 78 percent. Seasonal variations underline the need for a flexible system and emphasize the importance of regional planning. Table 19 indicates on a monthly basis the quantities of waste generated by tourists.

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[54] Commercial waste is generated by commercial establishments (i.e., amusement facilities, restaurants and retail stores). Residential waste is generated by single and multi-family dwellings.

[55] Composition varies between urban and rural areas. Variations include: Paper = 48% — Urban; 38% — Rural; Organics = 18% — Urban; 28% — Rural. The metal, glass, etc., remain the same.

[56] As city people move out into the Vermont countryside, they will probably retain their urban habits. This means high paper content and higher volumes of waste coming from areas classified as rural.

[57] These include all State institutions and hospitals — private, State, federal, general, specialty, etc.

[58] Type of hospital, i.e., general vs. mental hospital, will determine factor used to calculate total waste. The factors vary from 3 to 7 pounds per day per bed. Resource Planning Associates, *Hospital Study*, September 1972.

[59] Many Vermonters feel that the State should take a greater role in managing its own solid waste. State institutions would be good places to initiate new solid waste procedures. Presently, some institutions burn their waste and others use dumps. While State officials strictly control local offenders, State institutions often appear to be overlooked.

[60] The category includes waste generated by industrial processing and manufacturing operations. Standard Industrial Classification numbers (SIC) 19 to 39.

[61] Data based on a survey conducted by AEC of 100 manufacturing units with over 50 employees.

[62] *County Business Patterns*, 1970 — Vermont. U.S. Department of Commerce.

[63] This does not include demolition or trimming waste which goes directly to disposal sites.

[64] Estimate by Department of Budget and Management, Office of Statistical Coordination. In 1950, Agriculture accounted for 15 percent of the Gross State Product.

[65] While at present, disposal of agricultural waste presents no problem for the State, the continuing decrease in agricultural land could change this. Less land would mean lower demand for fertilizer. In an effort to face this problem now, the Vermont Department of Agriculture has submitted a proposal to the New England Regional Commission to study "The Feasibility of a Bio-Gas Generation Process and Efficient Handling, Storage and Utilization of Cow Manure on an Average Sized Vermont Dairy Farm." This process would enable each large farm to handle its own waste.

[66] The serious problem of whey pollution in Vermont has specifically not been included. Whey is a liquid waste product and jurisdiction for its disposal is under the Water Resources Department.

[67] Tourists include out-of-state skiers, vacation home owners, day-through-trip motorists, motels, campers, visiting relatives and friends.

[68] Source: Economic Development Division, Agency of Community and Development Affairs.

[69] This percentage is declining; the number of tourists is as high in the north as in the south. However, the region includes several larger towns and cities; therefore the municipal waste stream is larger.

Table 19

TOURIST-GENERATED WASTE

		% of Total Waste from Tourism[1]	Tons/Month
November		1	453
December		3	1359
January		5	2265
February	Winter[2]	7	3170
March		6	2717
April		1	453
May		6	2717
June		10	4529
July		19	8605
August	Summer[2]	21	9511
September		10	4529
October		11	4982
		100	45,290 Tons per year

[1] Based on data from:
Vermont vacation travel indicators-Sept. 1971-1972.
"The Vermont Ski Industry" - 1971-1972; Economic Development Division, Agency of Development and Community Affairs. July 1972.
Personal survey of private camping areas around State.
"The Vermont Summer Tourist Industry," 1971 - Economic Development Division, January 1972.

[2] The two seasons are divided as follows:

Winter	Summer
Skiers	Vacation home owners
Vacation home owners	Motorists
	Summer vacationers

Table 20 presents the quantities of waste generated by each category of tourists. Two categories, skiers and vacation home-owners, require further explanation. During the 1971-1972 season, one million skiers came to Vermont. This is equivalent to more than 2.1 million skier days.[70] The skiing season is estimated at 20 weeks from mid-November through mid-April. The waste generation factor used for skiers (8 pounds per skier-day) is based on data obtained from Vermont collectors covering ski areas.[71]

There are over 23,000 vacation homes in Vermont,[72] fifty-seven percent of which are owned by out-of-staters. The figures for waste generation by vacation home owners given in Table 20 cover only this portion. The waste generated by resident vacation home owners, although causing shifts in total waste entering specific disposal sites, does not drastically change the municipal waste stream on a statewide basis. Figure 19, *infra*, page 39, indicates, on a regional basis, the average and peak increases of the waste stream. Table 21 indicates the composition of the refuse by category of tourists.

Table 20

QUANTITIES OF WASTE GENERATED BY CATEGORY OF TOURISTS

Category	Number of Visitor Days	Generation Factor	Total tons/ Season	Percent of Tourist Waste
Campers	1,100,000	5 lbs./visitor day	2,750	6
Motels	5,300,000	5 lbs./visitor day	13,250	29
Visiting Relatives/Friends	3,600,000	3 lbs./visitor day	5,400	12
Renting cottages	1,200,000	5 lbs./visitor day	3,000	6.5
Day thru trip	2,700,000	3 lbs./visitor day	4,050	9
Skiers	2,100,000	8 lbs./visitor day	8,500	19
Vacation Home Owners	4,200,000	4 lbs./visitor day	8,350	18.5
TOTAL	20,200,000		45,300 tons/year[1]	100

[1] Does not include waste generated by more than 80 summer camps. Organized camps account for a very small portion of waste stream. Data on these were very sketchy.. From the publication by Agency of Development and Community Affairs, Vermont, *Summer Camps for Boys and Girls*, it was estimated that more than 13,000 visitor days were connected with youth summer camps. This would only add an additional 50 tons/year to the entire waste stream.

[70] A skier-day is from dawn to dawn.

[71] This is higher than the combined average figure for overnight and day lodges given by Spooner in EPA's study of waste generation in recreational areas (Spooner, Charles S., *Solid Waste Management in Recreation Forest Areas*, U.S. Environmental Protection Agency, Solid Waste Management Office, 1971)). However, it must be noted that the EPA's study was based on two ski areas only. Ranges from 2.13 to 8.77 pounds per visitor-day for day lodges and .91 to 3.23 for overnight lodges were obtained. In addition, the EPA study is based on a 12-hour visitor-day as opposed to 24-hour dawn to dawn measures used by Vermont's State statistics.

[72] *Vermont Vacation Home Survey*, 1968, prepared by Vermont Development Department. "*Non-Resident Ownership of Property in Vermont*" (Referred to here as "Non-Resident Bulletin.")) May 1972 — Bulletin 670 Agricultural Experiment Station, University of Vermont, Burlington.

Table 21

COMPOSITION OF TOURIST WASTE

Percentage by Weight

	SUMMER[1]	SKIERS	VACATION HOMEOWNERS
PAPER	50	25	48
METAL	10	20	9
GLASS	10	30	10
ORGANIC	25	20	18
OTHER	4	4	15
	100	100	100

[1] Including motorists, campers, cottage renters.

4. Special Waste Problems

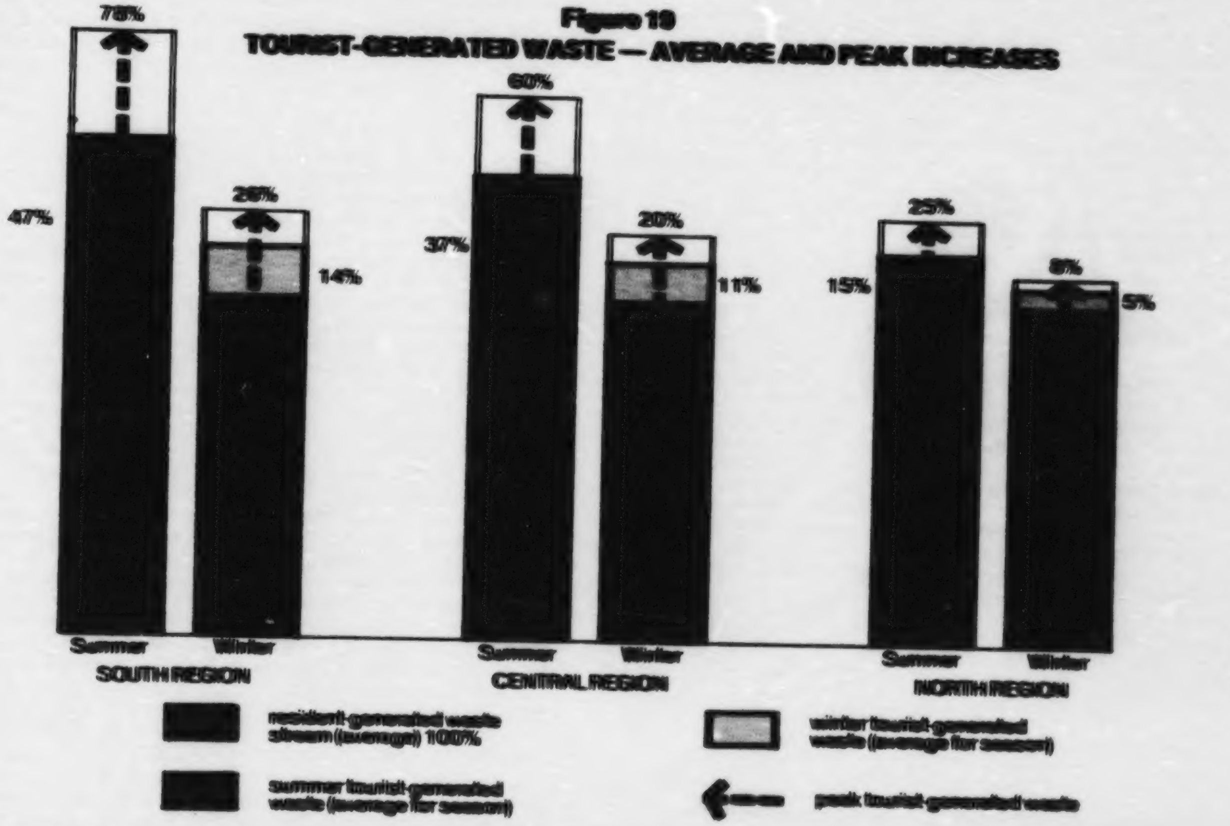
Tires, waste oils, demolition wastes and sewage sludges require special disposal procedures.

Tires. Two hundred twenty-nine thousand vehicles[73] were registered in Vermont in 1970. Resource Planning Associates estimates that 397,000 passenger tires and 90,000 truck and bus tires were discarded in that year.[74] This represents approximately 8,000 tons per year.[75] Eighty percent or 6,400 tons are found in the municipal waste stream and represent nearly 2 percent by weight of the total. The remaining portion of discarded tires is retreaded.

Rubber tires (already segregated from other wastes) are available in large quantities, however, major economic and technological factors limit recycling:

- live rubber tires refuse to submit to sanitary landfill burial. They resist compaction because of their resilience and tend to rise to the surface. In addition, they are not biodegradable.
- Common incineration cannot control or eliminate the airborne products of rubber combustion.
- Over 70 percent of discarded tire carcasses are unfit for retreading, and changing tire construction makes them more difficult to retread.
- Present reclaiming techniques limit the quantity of rubber which can be reclaimed. The reclaiming industry's output in 1968 was lower than in 1958 and is still declining.

Figure 19
TOURIST-GENERATED WASTE — AVERAGE AND PEAK INCREASES



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[72] Agricultural and wood wastes were discussed in the text supra, page 37. Bulky metallic wastes are analyzed in greater detail infra, page 48.

[73] One hundred eighty nine thousand automobiles and 39,950 trucks and buses.

[74] Based on national averages: 2.07 tires discarded per passenger car per year and 2.47 per truck or bus.

[75] Based on 23 pounds per passenger tire and 76 pounds per truck tire, i.e., average original weight minus 8 and 8.5 percent tread loss respectively. From *Rubber Reuse and Solid Waste Management*, U.S. Environmental Protection Agency, 1971.

Waste Oils. Resource Planning Associates estimates that 750,000 gallons of waste oils (including motor and industrial oils) were generated in 1972. Most of it is being reconditioned by specialized firms and sold for reuse. Disposal of waste oils and greases is limited.

- the high lead content of oils does not favor incineration. Approximately 1,100 pounds of oxides (including 650 pounds of lead oxide) are discharged into the air for every 10,000 gallons of waste oils which are incinerated.[76]
- disposal on land including the use of waste oil on town roads to suppress dust may result in water pollution.
- disposal in streams or sewers is unlawful.

Waste oils can easily be cleaned and reused, and for this reason resource recovery is the most efficient method of disposal. Waste oils can be stored in tanks at central locations before shipment to reconditioning firms.

Demolition Wastes. Resource Planning Associates estimates that approximately 28,000 tons of demolition and construction wastes were discarded in 1972. They included a large variety of materials: stones and stone products, wood and lumber, steel (reinforcing rods, beams, conduits), plaster, etc. Because of the bulky nature of demolition wastes, reduction before final disposal is advisable.

The low value of materials found in demolition wastes does not favor recycling or reuse. Most of the demolition wastes are in materials with limited application. The cost of incineration is high because it requires prior shredding, or special bulky waste incinerators.

The most economical method of disposal remains sanitary landfilling. However, demolition wastes cannot be compacted with other wastes because of their bulky nature. They require special compaction and should be landfilled separately. Demolition wastes do not, in general, require daily cover.

Sewage Sludges.[77] In November 1972 it was estimated that approximately 203,000 inhabitants of Vermont were served by sewage treatment plants. These plants currently produce 2,750 tons of sewage sludge per annum. The remainder of the population is served by septic tanks and leaching fields. It is not possible to ascertain the amount of sludge generated by this portion of the population. Because of Vermont's rural nature it is estimated that in the future, only 266,000 people will be serviceable by treatment plant.

At the present an estimated 95 percent of sludge generated at waste treatment plants goes direct to the local disposal site. The remainder is used as soil conditioner.

The disadvantage of this method of disposal is that there is considerable leachate of unconditioned sludge which affects the ground water. It is not a satisfactory method over the long-term as the sludge is not sufficiently reduced in volume and landfill capacity is limited. Sludge can be used as land conditioner or fertilizer on a large scale, providing it has undergone certain activating, thickening or digesting processes. In St. Mary's, Pennsylvania anaerobically digested liquid sludge has been spread on pastures, meadows and croplands every year since 1964 with beneficial effects. The City of Las Vegas, Nevada, uses all of its sewage sludge for the development of parks, recreational areas and cemetery facilities. However, in rural states such as Vermont, economies of scale do not permit the use of the incinerators and other treatment plants which are needed to process sewage sludge into a useful and acceptable state.

B. CURRENT PRACTICES

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The physical characteristics (size, composition, seasonal variations) considered in the previous section determine, to a great extent, practices in each solid waste activity (storage, collection, disposal and resource recovery). The following description of the current practices in Vermont, with particular emphasis upon the role of agencies presently involved in solid waste management, is fundamental to an understanding of Vermont's current problems and future solid waste management needs. Where possible, relevant data will be presented in tables and figures.

1. Solid Waste Activities

Storage. Table 22 summarizes storage regulations as reported by officials of the largest towns and municipalities. There is little control of on-site storage practices; less than one-third of the State's towns and municipalities have regulations. No information is available concerning solid waste storage practices at State government facilities, in industry or agriculture.

Collection. Although Saturday morning at the dump is still a Vermont tradition, trash collection is fast becoming an attractive business. Collection is no longer limited to urban centers, but is moving into Vermont's rural areas. The typical operation is small, a pick-up truck serving four or five streets. Often, several collectors service the same area.

The estimated proportion of residential refuse collected by organized collection services is illustrated in Figure 16, *infra*, page 32. An estimated 56 percent of the population is presently served by organized garbage collection. All methods of collection services are represented in Vermont. Bristol Village has municipal collection; Burlington, Brattleboro, Winooski, the Village of Richford, and Westminster have private collection under municipal contract; the remaining portion of the population served makes individual arrangements with private collectors. Collection ranges from curb service to centrally located town containers. Sherburne and Stratton in the southern part of the State and the towns of Burke, Ryegate and Wheelock in the North utilize containers. Occasionally, half the town has curbside collection, while the more rural area has a central container. Collection frequency is most often once per week. Current charges for collection services vary from $.75 to $1.50 per service, i.e., between $20.00 and $40.00 per ton.[78]

One of the largest trash collectors is the State itself. The 1,200 "Keep Vermont Beautiful" barrels located around the State collect more than 4,000 tons of trash per season. The Highway, Forest and Parks and Fish and Game Departments, equipped with 15 vehicles (including 3 packing units), provide roadside and rest areas pick-up services.[79] Schedules vary depending on the flow of tourists; on peak weekends during the summer, collection may be every day. Most of the barrels are out from April until the first snow. Those located along Interstate 89 and 91 and a few others in heavily used areas remain throughout the winter. Expenditures for the entire trash collection program totaled $188,000 in fiscal 1972.[80]

A new trash pick-up system was initiated in 1971. Using 3 packer-type garbage trucks, six men remove rubbish from 17 State Parks, 52 Fish and Game access areas and approximately 25 Highway Department roadside rest areas in 3 districts.[81]

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[76] Based on results of a survey by Walter C. McCrone Associates, Inc., July 1970.

[77] Source: Office of Waste Water, Department of Water Resources.

[78] In Bristol Village the cost per person per year is $2.00 (i.e., about $3.50 per ton)

[79] Collection is undertaken within each of the nine highway districts.

[80] 1971 expenditures — $175,000.

[81] Agency of Environmental Conservation — *Biennial Report*, 1970-1972, page 38.

Table 22

SUMMARY OF STORAGE REGULATIONS IN MAJOR CITIES AND TOWNS

November 1972

TOWN OR CITY	POPULATION (000)	MUNICIPAL COLLECTION	MUNICIPAL CONTRACT	PRIVATE COLLECTION	SPECIFIC REGULATIONS COVERING STORAGE OF WASTE*		DETAILS OF REGULATIONS IF ANY	ENFORCED BY
					YES	NO		
Burlington	38.6			X	X		Garbage containers must be covered. 30 gallon oil drums or other metal containers recommended. Garbage taken in trucks must be covered with canvas sheeting. Garbage may not be left at curbside but must be kept at back of house. Burning is still permitted by households of 4 units or less.	Health Dept. City Attorney
Rutland City	19.3			X	X		Garbage must be in closed containers	Health Officer on Complaint
Bennington	14.6			X		X		
Brattleboro	12.2		X		X		Refuse to be transported in closed vehicles or covered. Garbage must be covered.	Health Dept.
Essex	11.0			X		X		
Springfield	10.1			X		X		
Barre City	10.2			X		X		
S. Burlington	10.0			X		X		
Montpelier	8.6			X		X		
St. Johnsbury	8.4			X		X		
St. Albans City	8.1			X	X		Receptacles must be of certain size (10-40 gal.) and of metal or plastic. They must be covered.	Police
Winooski	7.3	(franchised)	X		X		All waste containers must be covered. Weight of container and contents must not weigh over 100 lbs. Magazines etc. may be bundled, but each bundle must not weigh over 100 lbs. Waste must be placed a given distance from outside walls.	Building Inspector/City Attorney
Barretown	6.5			X		X		
Hartford	6.5			X		X		
Rockingham	5.5			X		X		
Middlebury	6.5			X		X		
TOTAL	183.4							

*Municipal Ordinances only: this does not include Building Regulations or regulations of the Public Health Authority, nor State Laws.

This has proved to be a very efficient operation. Cost of collection for the Department of Forest and Parks alone decreased from $29,500 in 1970 to $8,900 in 1971.

Since the inception of the bulky metallic waste program, discussed *infra* page 46, 26,000 junked motor vehicles have been collected at State expense. The Highway Department will also guarantee removal of metallic wastes from communities when a large enough volume is reached.

Disposal. Most of the data on the 116 land disposal sites surveyed is presented in tabular form. Tables 23 and 24 present general information on open-dumps and Table 25 and 26 general information on open-dumps and Table 25 and 26 general information on "approved" landfills. Table 27 categorizes "approved" landfills by function of population served. Figure 17 indicates the location of "approved" landfills, open-dumps and junkyards. Figure 18 shows towns served by municipally and privately owned "approved" landfills.

Only 20 percent of the 53 "approved" landfills and none of the 63 open-dumps meet EPA proposed guidelines for sanitary landfills.[82] Approximately 325,000 inhabitants or 76 percent of the total population are not served by sanitary landfills. Private operations serve 46 percent of the population served by "approved" landfills or 38 percent of the total population. The 15 largest "approved" landfills (6 private and 9 municipal) account

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[82] For a definition of sanitary landfill see text supra, page 3.

Table 23

GENERAL INFORMATION ON OPEN-DUMPS (A)

December 1972

Name or Location	Ownership Public	Ownership Private	Population Served 1970	Acreage	General Characteristics
Alburg	X		1.3	10	Marsh, etc.
Arlington	X		1.9	3	Hillside
Belvidere	X		0.2	5	Quarry or borrow
Bloomfield	X		0.2	2	Hillside
Bolton	X		0.4	3	Quarry or borrow
Bridgewater	X		0.8	4	Hillside
Bridport	X		0.8	10	Level
Brighton	X		1.4	8	Gully Canyon
Brunswick	X		neg.	2	Gully Canyon
Canaan	X		0.9	3	Hillside
Cavendish	X		1.3	5	Gully Canyon
Charleston	X		0.7	3	Gully Canyon
Charlotte	X		1.8	4	Level
Chelsea	X		1.0	3	Gully Canyon
Concord	X		0.9	4	Gully Canyon
Corinth	X		0.7	4	Gully Canyon
Danville	X		1.4	4	Hillside
Derby	land leased		3.3	4	Hillside
Dover	X		0.6	6	Hillside
Franklin	operated	owned	0.8	10	Marsh, etc.
Georgia	operated	owned	1.7	4	Level
Granby	X		0.1	1	Hillside
Grand Is.	X		0.8	4	Level
Guildhall	X		0.2	1	Gully Canyon
Halifax	X		0.3	4	Quarry or borrow
Holland	X		0.4	2	Gully Canyon
Isle La Motte	X		0.3	2	Level
Jamaica	X		0.6	4	Gully Canyon
Kirby	X		0.2	5	Hillside
Lemington			USING COLEBROOK, NEW HAMPSHIRE		
Lincoln	X		0.6	2	Hillside
Ludlow	X		2.5	6	Gully Canyon
Lunenburg	X		1.1	2	Gully Canyon
Maidstone	X		0.1	1	Gully Canyon
Middlesex	X		0.9	6	Hillside
Newark	X		0.1	5	Hillside
Norton[1]	X		0.2	2	Hillside
Peacham	X		0.4	2	Hillside
Putney	X		1.7	5	Hillside
Readsboro	X		0.6	2	Hillside
Sandgate	X		0.1	4	Quarry or borrow
Shaftsbury	X		2.4	15	Hillside
Sharon	X		0.5	5	Gully Canyon
South Hero	X		0.9	3	Level
Stamford	X		0.8	4	Hillside
Starksboro	X		0.7	1	Gully Canyon
Strafford	X		0.6	3	Gully Canyon
Sunderland	X		0.6	3	Level
Topsham	X		0.7	3	Gully Canyon
Townshend	X		0.7	4	Gully Canyon
Tunbridge	X		0.8	5	Hillside
Victory	X		neg.	1	Gully Canyon
Wardsboro	X		0.4	4	Hillside
Washington	X		0.7	7	Hillside
Waterbury[2]	X		4.6	5	Marsh, etc.
West Haven	X		0.2	3	Gully Canyon
Weybridge	X		0.6	2	Gully Canyon
Wheelock	X		0.2	3	Hillside
Whitingham	X		1.0	4	Hillside
Williston	X		3.2	5	Hillside
Wilmington	X		1.6	4	Gully Canyon
Winhall	X		0.3	3	Hillside
Worcester	X		0.6	3	Gully Canyon
Total 63	61	2	55.5	249	

[1] Other unorganized towns in Essex County use this dump

[2] Duxbury and Moretown also use this dump

Table 24

GENERAL INFORMATION ON OPEN-DUMPS (63)

Number of Open-Dumps	63
Total Population Served	55,580
Average Acreage	4

- All dumps are open to the public
- All exclude sewage solids and junk automobiles
- 58 sites are publicly owned, one is run by the town on leased land, and two in Franklin County are privately owned but operated by the town

General Characteristics

Quarry or borrow pit	4
Level	8
Gully Canyon	23
Hillside	25
Marsh, tideland, flood plain	3
Total	63

Control

- At five sites burning is allowed
- There is no fire protection or vector control at any of the 63 sites examined
- Water pollution is actual or expected at eight sites
- At all sites cover takes place on an occasional basis
- At all sites the equipment used is the property of the town

for 71 percent of those served by "approved" landfills or 58 percent of the total population. Certain remote rural areas provide no convenient disposal facilities; this has led to roadside dumping[83] and backyard accumulation.

A survey of "approved" landfills[84] revealed variations in operating costs ranging from $2.40 to $9.00 per ton.[85] However, these costs don't differentiate between sanitary operations and dumps (see Table 28). Lower costs indicate that a disposal site is unsanitary although it is "approved." Average total community expenditure for disposal activities in 1972 was $2.45 per person per year.

There are currently 95 licensed junkyards in the State. The Department of Highways assists communities in establishing bulky metallic waste depositories (junk motor vehicles, large appliances, farm machinery, etc.). Communities may be reimbursed for up to 75 percent of the planning and development costs involved.

Although practically all of Vermont's municipal waste is disposed on land, the city of Rutland incinerated its refuse until the incinerator was shut down due to air pollution regulations.[86] By municipal ordinance, waste was segregated into combustible, noncombustible and garbage for incineration purposes. This was Vermont's only precedent for mandatory separation, and according to town officials, there was complete acceptance of the requirement. On February 1, 1971, the city reverted to mixed collection although the ordinance on mandatory separation was never formally repealed.

Resource Recovery. Only a small percentage of the State's municipal waste stream is being recycled by volunteer, commercial and public operations. Recycling in Vermont gained momentum around 1970. There was an initial period of enthusiasm when turnout and volume were high. However, over the past two years, it is increasingly difficult for individual recycling efforts to find markets for their materials within a reasonable distance.

Vermont's *Recycling Handbook*[87] lists 116 recycling centers, three of which have since closed. The others are continuing with varying degrees of success. The town of Manchester is taking over its recycling center, and other towns, such as Bennington and White River, have assisted their centers through loans of equipment and funds (see Table 29, *infra*, page 49).

There is very little data concerning the amount of waste recycled in the State. Figures for paper and glass have been compiled, but nothing on metal is available. This is mainly because very little metal recycling has been done. On the average, volunteer recycling centers recover one and a half tons of paper per week, and at their peak one and a half tons of glass per week. Glass was the major material recycled until the Burlington market closed down (see *infra*, page 43). Paper is now the primary material.[88]

There is no coordination among the many small volunteer groups associated with Vermont's recycling effort. Although individual recycling centers face many of the same problems, there is little communication even among groups within twenty miles of each other. This may be explained in part by the fact that individual volunteers cannot participate on a regular basis.

The largest private recycling effort in Vermont was run by James Fayette of Vermont Fruit and Grocery Company, Inc., Burlington. Initially subsidized by the bottlers of Vermont, Fayette invested in a paper baler and a glass crusher and established the Vermont Reclamation Center. With the incorporation of the "bottle packs" last summer, the bottlers removed their support and Mr. Fayette was forced to support the entire operation alone. Due primarily to lack of funds, he discontinued his operation. He handled 500 tons of glass and 330 tons of paper from August 1971 to September 1972.

Most of the State recycling efforts were forced to discontinue taking glass when the Vermont Reclamation Center closed down. The only other private recycling business is run by Harry K. Sheppard in Springfield. Mr. Sheppard collects only paper; the average amount is 10 tons per month. His profits are divided between himself and the organizations he collects from (i.e., Boy Scouts, high schools).

The quantity of aluminum recycled in Vermont is negligible

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[83] Highway officials unanimously agree that the greatest problem with the roadside litter barrels in some areas is household garbage. Percentage of garbage in motorists' waste range from 20 to 50 percent.

[84] These landfills were selected on the basis of size, location, and method of operation, as being representative of all 58 "approved" landfills.

[85] Adjustments were made to accommodate different accounting practices.

[86] The incinerator was subsequently destroyed by a windstorm.

[87] Vermont Division of Community Affairs and Environmental Protection Solid Waste Management Division, *A Recycling Handbook and Guide to Recycling Opportunities in Vermont*.

[88] Many recycling center directors felt that the publicity surrounding the closing of the Burlington market caused a decline in the volume of paper they received.

Table 25

GENERAL INFORMATION ON "APPROVED" LANDFILLS (A)

December 1972

Site	Ownership		Population Served (000)	Acreage	Yearly Input '000 cu. yds.	Estimated Residual Life Years	Days Per Week Open to Public	Salvage	General Characteristics
	Pub.	Pri.							
Barnard	X		0.6	10	0.5*	20	2	No	Hillside
Barnet	X		1.9	15	2.5	35	3	No	Quarry or Borrow Pit
Barre	X		16.7	5	30.7	3	6	No	Level
Barton	X		3.5	30	5.9	35	3	No	Hillside
Bennington	X		14.9	15	50.4	25	4	No	Quarry or Borrow Pit
Brandon	X		4.1	7½	7.4	10	3	No	Level
Brattleboro		X	16.3	25	19.0	7	6	No	Quarry or Borrow Pit
Bristol	X		2.7	3	5.0	50	5	No	Quarry or Borrow Pit
Bristol "Bowles"		X	12.8	10	34.5	13½	6	No	Quarry or Borrow Pit
Burlington	X		38.6	4	108.6	2	6	No	Marsh, Tideland, Flood Plain
S. Burlington	X		10.0	15	31.5	4	6	No	Gully Canyon
Cambridge	X	Oper.	1.9	5	2.7	75	2	No	Gully Canyon
Castleton	X	Oper.	3.1	10	5.5	20	3 or 4	No	Hillside
Colchester		X	20.5	25	60.0	8	6	No	Gully Canyon
Derby		X	1.1	4	1.9	13	3	No	Quarry or Borrow Pit
Eden	X		0.5	15	0.9	70	3	No	Hillside
Enosburg		X	2.8	10	3.7*	17	3	No	Quarry or Borrow Pit
Essex	X		11.0	10	3.9	5	6	No	Gully Canyon
Hardwick		X	5.3	10	21.0	12	6	No	Level
Hartford	X	Oper.	8.3	25	26.0	14	6	No	Gully Canyon
Highgate		X	21.3	50	60.9	14	6	No	Quarry or Borrow Pit
Hinesburg	X		4.0	50	3.7*	30	3	No	Quarry or Borrow Pit
Irasburg	X		0.8	5	2.0	28	3	No	Quarry or Borrow Pit
Jericho	X		2.3	40	5.0	41	3	No	Hillside
Johnson	X		1.9	85	2.5*	35	4	No	Quarry or Borrow Pit
Londonderry	X		2.1	10	2.1	26	7	No	Hillside
Lyndonville		X	6.8	60	6.1*	25	5	No	Gully Canyon
Manchester	X		4.2	15	6.8	6	5	No	Hillside
Milton	X		4.5	80	8.5	30	3	No	Gully Canyon
Montgomery		X	2.8	8	3.7*	10	3	No	Hillside
Montpelier		X	17.9	40[1]	60.0	5	6	No	Gully Canyon
Morgan[2]	X		0.3	10	0.3*	n/a	3	No	Level
Morrisville		X	5.7	4	15.9	6	5	No	Gully Canyon
Newbury		X	3.1	10	5.9	10	3	No	Hillside
Newfane	X		1.1	4	2.0	2	4	No	Level
Newport		X	9.9	10	45.0	14	6	Cardboard	Hillside
North Hero	X		0.4	4	0.4*	10	3	No	Level
Poultney	X		3.2	1	5.2	1	6	No	Level
Pownal	X		2.4	4	6.5	8	6	No	Level
Proctor	X		2.1	9	6.1	10	2	No	Marsh, Tide or Flood Plain
Randolph	X		4.6	4	2.5*	2	6	No	Hillside
Rochester		X	1.5	10	1.6*	20	6	No	Hillside
Royalton-Bethel	X		2.7	10	5.6	25	4	No	Hillside
Roxbury		X	5.2	10	2.8*	25	5	No	Quarry or Borrow Pit
Rutland	X		22.8	15	60.0	2	6	No	Level
St. Johnsbury	X		8.4	6	30.0	3	6	No	Gully Canyon
Salisbury	X	Oper.	4.0	15	4.3*	20	3	No	Hillside
Springfield		X	25.4	8	90.0	4	6	Cardboard	Quarry or Borrow Pit
Underhill	X		1.2	5	1.3*	10	2	No	Hillside
Weathersfield		X	6.9	8	30.0	4	6	No	Hillside
Westford		X	2.8	4	3.9	7	4	No	Hillside
Williamstown	X		1.8	45	1.9	52	3	No	Quarry or Borrow Pit
Wolcott	X		0.7	20	0.4*	35	3	No	Hillside
Total			352.4	1,012	845,000 cu. yd and 33,800 tons	Population weighted 10.8			

* '000 Tons

[1] Excludes new parcel

[2] Opens 11-18-72

Table 26

GENERAL INFORMATION ON "APPROVED" LANDFILLS (B)

Ownership

	No.	%
Publicly Owned & Operated	31	58
Publicly Owned, Privately Operated	4	8
Privately Owned & Operated	18	34
Total	53	100

Population Served

	(000)	%
Population Served	352.4	100
Population Served by Privately Owned Sites	168.1	46
Population Served by Publicly owned Sites	194.3	54

Acreage

	Acres	%
Total Acreage SLF's	1016	100
Acreage, Privately Owned	406	40
Acreage Publicly Owned	606	60

Yearly Input

		%
14 Respondents: '000 tons:	33.8	100
of which Privately Owned	17.9	53
Publicly Owned	15.9	47
34 Respondents: 000 cu. yds. of which	846.7	100
Privately Owned	457.0	54
Publicly Owned	389.7	46

Items Excluded

	No. of "Approved" landfills
Sewage Solids Only	12
Sewage Solids and Junk Autos	35
Sewage Solids and Large Appliances	1
Junk Autos Only	3
Sewage Solids, Junk Autos and Demolition Waste	1
Sewage Solids, Junk Autos and Large Appliances	1
Total	53

Cover Materials

	No. of SLF's
Loam	14
Sandy	14
Sandy Clay	9
Gravel	6
Loam and Sand	4
Loam and Gravel	3
Clay	2
Loam and Clay	1
Total	53

Characteristics of Site

	No. of "Approved" landfills
Hillside	18
Quarry or Barrow Pit	14
Gully Canyon	10
Level	9
Marsh, Floodland, Floodplains	2
Total	53

- All "approved" landfills are open to the public
- In two "approved" landfills cardboard is salvaged,
- At 43 sites burning is not allowed, at the remaining 10 burning of natural wood only is permitted

Control

- Two sites are equipped with water under pressure the remainder have no fire protection
- One site operates dust control, the remainder do not
- No sites operate vector control or blowing litter control
- Surface water is drained at 49 of the 53 "approved" landfills examined
- Visible leachate is present at one of the 53 "approved" landfills examined

Cover

- At 52 sites cover takes place daily, at one site it takes place weekly
- At 51 sites the cover material is on site, two sites import cover
- Where indicated the compacted depth of cover was 8 feet

Table 27

EXISTING APPROVED LANDFILLS BY POPULATION SERVED

Population Served (000)	<4		4-8		8-20		20-50	50+
CATEGORY	1		2		3		4	5
Barnard	569	Brandon	4060	Barre	16,718	Burlington	38,633	
Barnet	1928	Hardwick (P)	5293	Bennington	14,872	Colchester (P)	20,561	None
Barton	3523	Hinesburg	4024	Brattleboro (P)	16,258	Highgate (P)	21,311	
Bristol	2744	Lyndonville (P)	6768	Bristol (P)	12,812	Rutland	23,821	
Cambridge	1925	Manchester	4212	Essex	10,951	Springfield (P)	25,484	
Castleton	3065	Milton	4495	Hartford	8,283	TOTAL	129,820	
Danby (P)	1094	Morrisville (P)	5691	Montpelier (P)	17,887			
Eden	513	Randolph	4633	Newport (P)	9,800			
Enosburg (P)	2849	Roxbury (P)	5224	South Burlington	10,032			
Irasburg	775	Weathersfield (P)	6586	St. Johnsbury	8,409			
Jericho	2343	TOTAL	51,066	TOTAL	126,092			
Johnson	1927							
Londonderry	2065							
Montgomery (P)	2767							
Morgan	286							
Newbury (P)	3067							
Newfane	1080							
North Hero	364							
Poultney	3217							
Pownal	2441							
Proctor	2095							
Rochester (P)	1528							
Royalton (P)	2746							
Salisbury	3951							
Underhill	1198							
Westford	2813							
Williamstown	1822							
Wolcott	676							
TOTAL	55,371							
Number of "approved" landfills in category = 28		10		10		5		
12% Total Population 15% Population Served		11% Total Population 14% Population Served		28% Total Population 35% Population Served		29% Total Population 36% Population Served		

(P) = Privately Owned

Total number of inhabitants served: 362,369 = 81% Total Population
Private serve 168,100 = 46% of Population Served by "Approved" Landfills
= 38% of Total Vermont Population
15 "approved" Landfills serve (6 private and 9 municipal) 255,912 = 71% of Population Served
58% of Total Vermont Population
"Approved" sanitary landfills serve 117,442 = 26.4% of Total Vermont Population

when compared with the total waste stream. According to the Aluminum Association there are four Aluminum Recycling Centers in Vermont.[89] Three of the recycling centers surveyed pay 10c per pound for flattened, 100 percent aluminum cans. The cans collected are shipped to the Narragansett Brewery in Cranston, Rhode Island. Quantities vary from 0 to 400 pounds per week.[90]

It is estimated that a total of 95,000 to 100,000 junked motor vehicles were collected and processed since 1969 under the bulky metallic waste program. However, an estimated 220,000 carcasses are still in inventory. Table 30 presents statistics on the collection and processing of junk motor vehicles.

Early in 1972, the Department of Highways conducted a project to test the reuse of glass as road payment. Fifty tons of glass containers were crushed at a commercial stone crushing plant; crushed stone was added in varying quantities. The mix which most nearly met the requirements of the Highway Department was hauled to the paving site and rolled. Traffic was then allowed to travel over the finished surface.[91] Results of this test indicated that technically a 50-50 glass-stone mixture was adequate.[92] (The mix did not separate at any point; no problems were experienced in laying down the glassphalt surface; no flushing or bleeding had occurred between the date of the experiment and the date the report was written.) However, glassphalt may not be economically justified since commercial crushed glass is more expensive than normal aggregates.

Resource recovery has also been approached indirectly in Vermont. In 1955 a law was passed which prohibited the sale of beer or ale in non-returnable glass containers until March 1, 1957. A two-man committee was set up to inquire into the advantages and disadvantages of this ban. It advised against continuation of the ban, which duly lapsed in 1957.

In 1971 a new bill prohibiting the sale of beer and non-alcoholic beverages in non-returnable containers was introduced. Amendments providing for a tax but no ban on all non-returnable containers were passed. The final bill, enacted in 1972, incorporated a four mill tax[93] to be replaced by a deposit charge of 5 cents on returnable containers and a ban on non-returnable containers effective July 1, 1973.[94] The revenue which will be collected from the beverage container tax has been estimated as high as $3.2 million per annum[95], but is probably as low as $600,000. The bill provides for the first million to be distributed to communities for "approved" landfills. Funds above one million will be allocated to the Environmental Protection Agency for establishing recycling centers.

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[89] Twin State Fruit Corporation, Rutland; St. Johnsbury Beverage Company, Inc., St. Johnsbury; and Twin State Fruit Corporation, White River Junction were contacted by Resource Planning Associates. The fourth center, A.B. & C. Distributors Inc., Essex Junction had no listed telephone number.

[90] While only cans are presently being collected, no one ruled out the possibility of recycling other aluminum items. St. Johnsbury Beverage Company did accept other materials for a while but what they received was dirty and could not be used.

[91] The length of the road used for the glassphalt test was 0.42 miles.

[92] Based on *Glassphalt Test Road* — Summary of Report by F.E. Aldrich, Paving Engineer and R.H. Snow, Bituminous concrete engineer, June 1972.

2. Solid Waste Authorities

Governmental agencies — federal, state, and local — are the backbone of a solid waste management program. Several federal agencies[96] have very significant solid waste responsibilities in Vermont. However, their activities are nationwide and are not under the control of a particular state. This discussion will, therefore, focus on the key State, regional, and local agencies which are directly and solely concerned with solid waste management in Vermont.

Until 1969, most solid waste authority lay with the Department of Public Health, which had little time or money to devote to it. On June 1, 1970, the Agency of Environmental Conservation (AEC) was formed and given responsibility for solid waste problems. In early 1972, all solid waste and air pollution programs were combined into one section[97] under the Division of Protection.

Summary of Key Agencies. *Towns and cities* are responsible for providing and maintaining proper means for disposal of garbage and refuse (24 VSA § 2201(a)).[98] An opinion from the Attorney General's Office established that bulky metallic wastes are included under the definition of "refuse."

Under the Bulky Metallic Waste Program[99], towns are responsible for the operation of the collection site, the collection of junk vehicles from within their boundaries, and the acceptance of all debris from stripped junk vehicles (at no cost to the State). Furthermore, the zoning authority of towns and municipalities could have significant impact on landfill locations and operations.

The purpose of the *Regional and Municipal Planning and Development Commissions*, created under Vermont Planning and Development Act (24 VSA Chapter 91) is to "encourage appropriate development of all lands in Vermont." Some of their specific duties (e.g., protection of soil, water and other natural resources, or protection of public health by reduction of noise, air pollution, water pollution, and other obnoxious physical influences) are directly related to solid waste generation and management. Several regional plans were adopted under this act. Under § 4348, sub. 3 (4), sewage and refuse disposal are part of the utility and facility plan.

The *Department of Agriculture* is responsible for regulation of the sale and use of pesticides and disposal of pesticides and pesticide containers.[100] Current legal standards for disposal of pesticides and containers include:

paper bags: informal agreement to burn them in small quantities on the farm.

small containers: crushed container to be buried in

Table 28

EXISTING "APPROVED" LANDFILLS—OPERATING COSTS

Landfill	1	2	3	4	5	6
Rating (1)	Excellent	Fair	Fair	Poor	Excellent	Poor
Type of Operation	municipal	municipal	municipal	municipal	private	private
Size (acres)	7	20	30	7	45	3
Population served(2) ('000)	8-20	20-50	8-20	8-20	20-50	less than 4
CAPITAL INVESTED						
a. Land	—	—	—	—	18,000	3,000
b. Design, Planning and site preparation	—	1,100	2,000	1,500	9,500	—
c. Facilities	—	4,900	4,000	3,500	7,000	2,000
d. Equipment	64,000	53,000	52,000	56,000	71,000	22,000
Total Capital Invested	64,000	59,000	58,000	61,000	105,500	27,600
OPERATING COSTS						
a. Personnel (including 15% fringe benefits)	26,000	31,100	8,740	10,700	18,400	4,500
b. Overhead (taxes, insurance, fuel)	300	5,250	8,460	1,750	24,800	1,450
c. Depreciation	41,000	39,400	7,000		8,600	1,400
d. Repair and Maintenance	(3)	1,000	(3)	7,000	4,500	2,000
e. Interest or lease	—	—	2,800	—	7,075	—
f. Cover Materials	—	18,000	—	9,000	6,000	—
Total Operating Costs	7,900	94,750	27,000	28,450	69,375	9,350
OPERATING COST PER TON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
adjustments (4)	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]
ADJUSTED COST PER TON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

1 All 6 landfills are "approved." Excellent and fair relates to sanitary landfill; poor relates to dumps.
2 Ranges are used to keep the location anonymous.
3 Repair and maintenance costs are included in overhead.
4 Adjustments were necessary to make figures comparable. Included in these adjustments are interest, use of city garages or other facilities.

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[93] 4 cents per beverage container

[94] Thus the State of Vermont will no longer derive revenue from the container tax.

[95] Vermont Environmental Report — EPIC-VNRC April 1972, page 5.

[96] Including the Office of Solid Waste Management (created by the Solid Waste Disposal Act of 1965) of the Environmental Protection Agency, the United States Department of Agriculture, the United States Army, the Bureau of Land Management, Geological Survey, etc.

[97] Air Pollution and Solid Waste Control Section.

[98] Appendix V, infra, page 72 presents a digest of solid waste statutes and regulations presently enforced in Vermont.

[99] See infra, page 51

[100] Enforcement power to license all "economic poisons" and to fine up to $500.00 for each violation.

Table 29

LIST OF RECYCLING CENTERS (NONPROFIT OPERATIONS)

as of December, 1972

Location	Items	Contact (Name and Phone)
BARNET	Glass, Paper, Cans	Merrill McLaren (802) 633-2681
BARRE	Glass, Paper, Cans	Stanley Flind (802) 476-4811
BENNINGTON	Paper, Cans	Adrian Ader (802) 442-5814
MANCHESTER	Glass, Paper, Cans	Sue Tanner (802) 362-1407 Town will take over operation
MONTPELIER	Glass, Paper	William Haines (802) 223-6460
MIDDLEBURY	Paper, Aluminum Cans	Richard Ashly (802) 388-2375
NORTHFIELD	Paper, Glass	Joe McDaniels (802) 485-8569
STAMFORD[1]	Glass, Paper, Cans	Michael Shay (413) 664-9852
WHITE RIVER JUNCTION	Glass, Paper, Cans	Betty Sherrard (603) 643-4505
WOODSTOCK	Glass, Aluminum Cans	Frank Teagle (802) 457-1350

[1] In connection with the recycling program operated by Williamstown, Massachusetts.

Table 30

JUNK MOTOR VEHICLE STATISTICS

Year	Additional Contracts	Additional Communities Served	Total Tons crushed	Total Cost $	Average Per Ton $	Reimbursed to Comms. $	Average Per Ton $
1969	15	25	5,822	39,307	6.63	4,163	0.76
1970	17	21	7,171	73,258	10.01	4,420	0.72
1971	15	33	7,449	14,176	1.90*	6,050	0.95
1972	8	18	5,512	21,143	3.84	6,371	1.16**
Total	55	97	25,954	147,884	5.70	21,004	0.81

No. of junks collected since inception of program approximately:

State Expense	26,000
Contractors	70,000-75,000
Total	96,000-101,000

*Figure unusually low due to favorable scrap market in Everett, Massachusetts.
**Now adjusted to a minimum of $1.00 per ton.

Table 31

SOLID WASTE STREAM – PROJECTIONS

	1970 Census	1975	1980
Population	444,732	468,100[1]	497,300[1]
Waste generation per capita per day (including waste generated by tourists)	3.85 lbs. 12.5%	37% 4.35 lbs.	5.30 lbs.
Total Waste Stream ('000 tons per year)	313	17% 367 51%	474

[1] Central Planning Office Projections.

Figure 20

AGENCY OF ENVIRONMENTAL CONSERVATION-ORGANIZATIONAL STRUCTURE

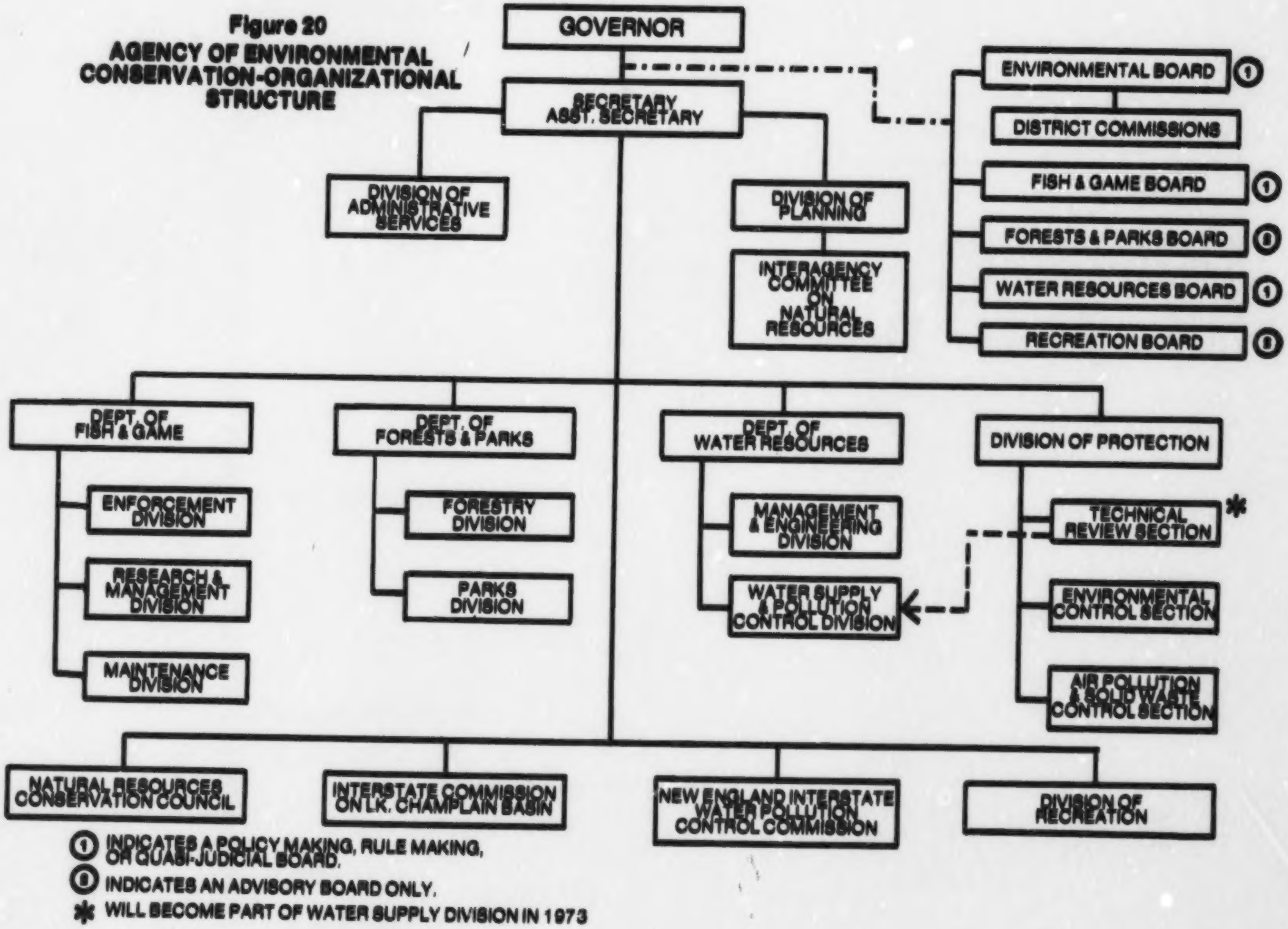
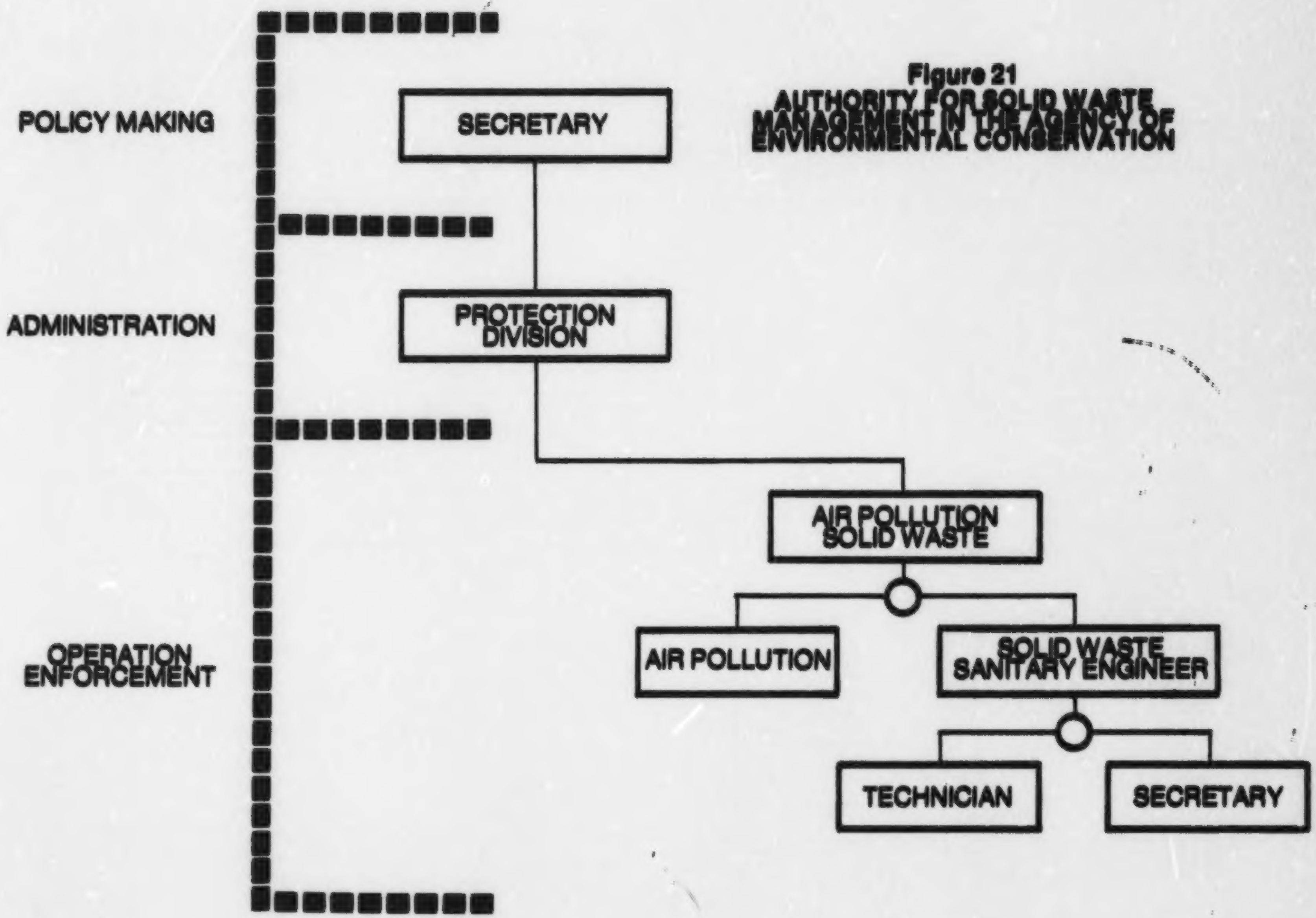

GOVERNOR
SECRETARY
ASST. SECRETARY
DIVISION OF ADMINISTRATIVE SERVICES
DIVISION OF PLANNING
INTERAGENCY COMMITTEE ON NATURAL RESOURCES
ENVIRONMENTAL BOARD ①
DISTRICT COMMISSIONS
FISH & GAME BOARD ①
FORESTS & PARKS BOARD Ⓢ
WATER RESOURCES BOARD ①
RECREATION BOARD Ⓢ
DEPT. OF FISH & GAME
ENFORCEMENT DIVISION
RESEARCH & MANAGEMENT DIVISION
MAINTENANCE DIVISION
DEPT. OF FORESTS & PARKS
FORESTRY DIVISION
PARKS DIVISION
DEPT. OF WATER RESOURCES
MANAGEMENT & ENGINEERING DIVISION
WATER SUPPLY & POLLUTION CONTROL DIVISION
DIVISION OF PROTECTION
TECHNICAL REVIEW SECTION *
ENVIRONMENTAL CONTROL SECTION
AIR POLLUTION & SOLID WASTE CONTROL SECTION
NATURAL RESOURCES CONSERVATION COUNCIL
INTERSTATE COMMISSION ON LK. CHAMPLAIN BASIN
NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION
DIVISION OF RECREATION
① INDICATES A POLICY MAKING, RULE MAKING, OR QUASI-JUDICIAL BOARD.
Ⓢ INDICATES AN ADVISORY BOARD ONLY.
* WILL BECOME PART OF WATER SUPPLY DIVISION IN 1973

Figure 21
AUTHORITY FOR SOLID WASTE
MANAGEMENT IN THE AGENCY OF
ENVIRONMENTAL CONSERVATION


POLICY MAKING
ADMINISTRATION
OPERATION ENFORCEMENT
SECRETARY
PROTECTION DIVISION
AIR POLLUTION SOLID WASTE
AIR POLLUTION
SOLID WASTE SANITARY ENGINEER
TECHNICIAN
SECRETARY

sanitary landfill (reserved area).

large containers (55 gallon drums): containers to be reconditioned by specialized firm.

The *Department of Health* has responsibility for the control of health hazards. Disposal practices are regulated by Vermont Health Regulations, Chapter II, and the regulations on sewage sludge, effluent and waste adopted by the State Board of Health. However, except for regulations concerning food and lodging establishments, enforcement authority is in the Protection Division of the Agency of Environmental Conservation.

Some of the responsibilities of the *Department of Highways* were discussed earlier in this report. It collects and disposes of litter accumulated at rest stops, as well as along the center lanes and rights of way of State highways. Twenty-four VSA, Chapter 51, Sub. 10 gives the State Highway Board "authority" and responsibility for control and regulation of junkyards including the collection and disposal of junk vehicles, the determination of sites for such collection and the disposal of junk vehicles and other bulky metallic waste through the medium of contracting services. The State Highway Board is in charge of licensing and controlling junkyards, auto graveyards and other bulky metallic waste depositories. In addition, since inception of the Green-Up campaign program in 1970, the Department of Highways played a monitoring role.

The *Department of Taxes* of the Agency of Administration collects, audits and enforces the four mill beverage container tax which went into effect on July 1, 1972. The same agency is also in charge of distributing the revenues from this litter levy to the towns and municipalities.

The *State Police*, a part of the Department of Public Safety, enforce the anti-littering law on the highways.

The Agency of Environmental Conservation (AEC). The AEC was created in 1969 (3 VSA Chapter 51) to regroup the major natural resource departments and all the pollution control activities.[101] Figure 20, *infra*, page 49 presents the organiza-organizational structure as of July 1972.

The *Division of Protection*, a separate entity within the Agency, handles policy formation, administration, operation and enforcement for solid waste matters. This Division was "created ... as a successor to the Department of Health on all matters relating to water pollution, air pollution; environmental radiation pollution; disposal of wastes of all types, including sewage and solid waste; and the granting of Building Permits for all public buildings except hospitals and nursing homes."[102]

The secretary of the AEC makes all final decisions. However, the Director of the Division of Protection handles most administrative procedures and financing, and the Chief of the *Air Pollution and Solid Waste Control Section* monitors and enforces solid waste regulations (Figure 21 outlines the authority for solid waste in the AEC). Total employment of the AEC is 384, of which 23 are part of the Division of Protection. Of these, three — one sanitary engineer, one technician, and one secretary — are paid from the solid waste budget. The expenditures of the Agency for solid waste management amount to nearly $85,000 per year of which 50 percent comes from State funds and the remaining portion from federal funds.[103]

This Section can and does draw skills from other organizations — geologists, soil technicians, engineers, etc. from the Department of Water Resources, hydraulic and sanitary engineers from the Department of Highways, etc.

Most of the work done in solid waste management by the Solid Waste Control Section has been enforcement. No one is presently charged with providing guidance and technical support to local communities. Funds are available for a public relations specialist, but the position has not yet been filled. The Director of the Division of Protection sees the organization in a transitory phase, moving from a preliminary enforcement to a permit coordinating function and eventually to a position of resource management.

Within the AEC, the Departments of Fish and Game, and Forests and Parks have responsibility for litter collection from State recreation areas. The Department of Water Resources regulates the relationship between sanitary landfills and water systems.

3. Projections

Statistical data relating to solid waste generation indicate that generation has been increasing at 4 to 6 percent per year over the last decade. Because of the present emphasis on resource recovery, increases in the near future will certainly tend toward the lower value. Per capita waste generation, as indicated in Table 31, will increase from 0.7 tons per year during the 1970-1972 period to nearly 1 ton per year in 1980.

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[101] Department of Fish and Game, Forests and Parks and Water Resources and the National Resources Conservation Council and the *Division of Recreation*. The transfer became effective June 1, 1970. Source: *Agency of Environmental Conservation — Biennial Report*, 1970-1972, page 2.

[102] *Agency of Environmental Conservation — Biennial Report*, 1970-1972, page 11.

[103] Solid waste accounts for approximately 2 percent of the total agency budget (including solid waste control section and other programs).

APPENDIX I
ECONOMIC ANALYSIS

Outline of Appendix I

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This Appendix presents background economic analysis of the solid waste management alternatives considered for the State of Vermont (see Table 3 in text, supra, page 9). It is practically impossible to condense into a few pages all the economic analysis undertaken for this study. Rather, the aim is to present the most critical assumptions and data in order to allow the reader to test them.

I. SANITARY LANDFILL ALTERNATIVES

For purposes of analysis, sanitary landfills were classified into one of the following 5 categories,[1] based on the population served.

Category	Population Served ('000)
1	0 - 4
2	5 - 8
3	9 - 20
4	21 - 50
5	51 - 100

Future operating costs will depend upon the type, size, and quality of operation desired. Tables 32 and 33 indicate hypothetical yearly operating costs and capital investment per category of sanitary landfill. These hypothetical operations, which assume optimum conditions, were developed specifically for Vermont.

As illustrated in Figure 22, operating cost per ton ranges from $7.30 to $2.25. Eighty percent of the operating costs of a landfill are fixed. This means that the greater the volume of waste handled by these landfills, the lower the cost per ton will be. Currently, 95 percent of the existing 53 "approved" landfills operate on the left side of the curve as illustrated in Figure 22.

A. *Upgrade existing disposal sites*
- upgrade existing 53 "approved" landfills to meet EPA proposed guidelines and state regulations.
- require these sanitary landfills to accept waste from remaining 20 percent of population, and close all open dumps.
- serve those who have no landfill within acceptable driving time through 5 regional transfer stations.

B. *Consolidate into regional sanitary landfills*
- consolidate existing 53 "approved" landfills into regional sanitary landfills.
- require these sanitary landfills to accept waste from 100 percent of population, and close all open dumps.
- serve those who have no sanitary landfill within acceptable driving time through 20 regional transfer stations.

Table 34 indicates the average disposal cost per ton under alternative IB. Figure 23 indicates the capital and operating costs under both sanitary landfill alternatives (upgrade or consolidate).

TABLE 32
YEARLY OPERATING COSTS PER SANITARY LANDFILL SHOWING VARIATIONS BY POPULATION SERVED

	POPULATION SERVED (in thousands)				
	0-4	5-8	9-20	21-50	51-100
a. Fixed Costs					
• Interest @ 6%	1,500	1,500	4,200	6,600	7,500
• Personnel (including 15% fringe benefits)	9,000	9,000	9,000	18,000	18,000
• Overhead (taxes, fuel, insurance)	1,000	1,000	1,500	2,000	4,000
• Depreciation (equipment[1] and facilities[2])	5,575	5,575	12,575	19,550	21,750
b. Variable Costs					
• Cover materials	—	—	—	—	—
• Repair & Maintenance (equipment[3] and facilities[2])	2,800	2,800	4,800	4,975	6,075
• Rental Standby Equipment	350	350	500	1,000	1,000
• Fuel and Oil (facilities and equipment)	1,500	1,500	2,000	2,500	3,000
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[1] Useful life of 5 years - straight line.

[2] Useful life of 10 years - straight line.

[3] Half of the initial cost of the equipment over its anticipated useful life.

[4] Totals to nearest $,000.

[5] Based on .7 ton of waste per year per capita.

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[1] Because of the rural nature of the State, larger landfills are impractical.

TABLE 33

CAPITAL INVESTMENT REQUIRED PER LANDFILL SHOWING VARIATIONS BY POPULATION SERVED

	POPULATION SERVED (in thousands)				
	0-4	5-8	9-20	21-50	51-100
a. Land[1]	—	—	—	—	—
b. Design and Planning	750	750	1,250	2,500	4,000
c. Site Preparation[2]	1,500	1,500	3,000	5,000	6,500
d. Facilities • Administration • Garage and Storage • Sanitation	5,750	5,750	5,750	9,500	11,500
e. Equipment • Crawler dozer[3] • Wheel loader • Weight scale	25,000	25,000	60,000	93,000	163,000
[redacted]					

[1] Cost of land excluded

[2] Does not include extensive access roads

[3] Includes dozer blade, landfill blade and front-end loader

[4] Totals to nearest $,000.

[5] Based on .7 ton of waste per year per capita.

Table 34

OPERATING COSTS OF REGIONAL SANITARY LANDFILLS[1] NO RESOURCE RECOVERY

	Area of Regional Landfill[2]	Population Served	MUNICIPAL WASTE STREAM by type of generation (Tons per year)				Operating Cost (Rounded to Nearest $'000 Per Year)
			Urban	Rural	Transient	Total	
1.	Highgate	30,548	10,200	9,150	1,850	21,200	64,000
2.	Newport	20,430	3,300	13,500	2,500	19,300	63,000
3.	Colchester	101,853	48,500	22,650	3,650	74,800	135,000
4.	Lyndon	30,981	—	17,150	2,200	19,350	63,000
5.	Montpelier	52,588	25,500	9,850	5,850	41,250	93,000
6.	Bristol	23,834	8,400	6,200	4,400	19,000	62,000
7.	Castleton-Rutland	55,749	21,150	1,450	4,750	27,350	77,000
8.	Bennington	30,812	5,000	12,850	3,650	21,500	65,000
9.	Brattleboro	22,588	6,500	7,300	4,750	18,550	68,000
10.	Rockingham	29,303	6,550	10,350	6,550	24,450	73,000
11.	Hartford	38,883	—	21,150	4,750	25,900	73,000
[redacted]							
Operating Cost Per Ton Landfilled[3]							$2.60

[1] Based on current level of municipal waste stream.

[2] Locations of the regional sanitary landfills are by no means definite or final - areas used in this table have been selected only for purposes of analysis.

[3] In this case the total municipal waste stream is landfilled.

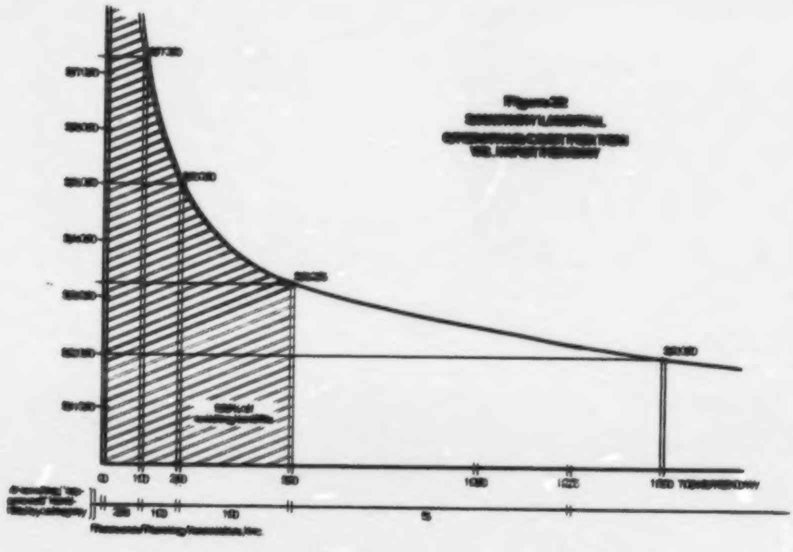

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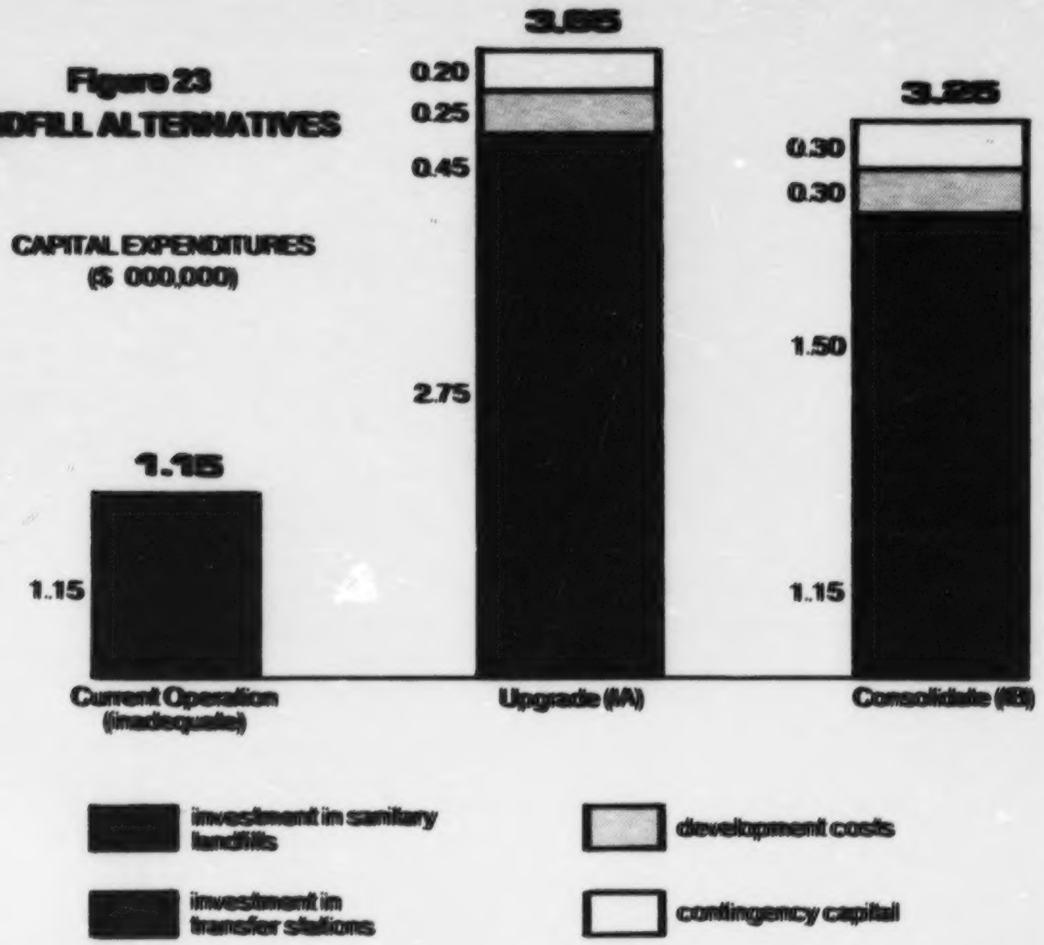
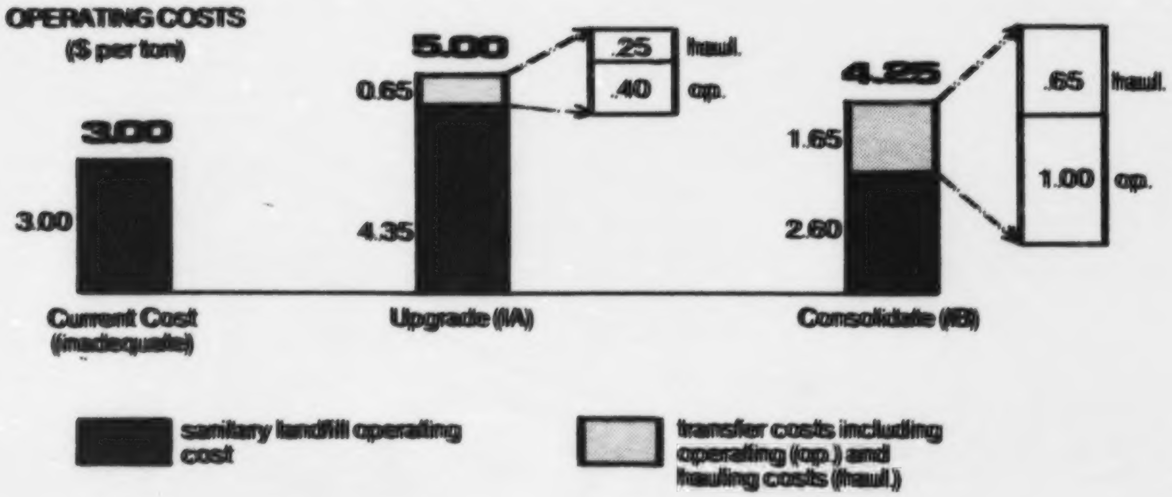
Figure 23
LANDFILL ALTERNATIVES





II. ENERGY RECOVERY ALTERNATIVES[2]

There is virtually no historical experience with energy recovery. Some steam recovery systems are operating in Europe, but published data are sparse and are unlikely to be directly applicable to the United States. Several systems are in the pilot plant development state in this country and at least one large and several small incinerators with steam recovery equipment are operating; but no long-term experience exists. Therefore, in evaluating either the technology or economic conditions it is nearly impossible to arrive at totally defensible conclusions.

Four systems were considered:

1. Municipal Incinerator Without Energy Recovery (for reference)

- Capital required is 5-12 thousand dollars per ton of daily capacity, thus a
  - — 200 ton per day plant would cost $1-2.4 million or a
  - — 1000 ton per day plant would cost $5-$12 million; and
- Operating costs vary between $3 and $7 per ton;
- Total costs vary between $6 and $20 per ton;
- Factors affecting costs: geographical differences affecting labor and material costs, composition and moisture content of incoming refuse, plant scale, air pollution costs;

2. Municipal Incinerator with Steam Generation — Add-on Equipment

- On the average should add approximately $2/ton of input refuse to total costs;
- Total costs = $9-$25 per ton — note that these plants will typically use the most sophisticated equipment and therefore will tend toward the upper cost range;
- Typical equipment would be either a) a waste-heat boiler or b) a water-walled furnace (more common in a newer facility);
- A steam recovery system must be located near the users of steam and where a steam distribution system exists;[3]
- A typical steam recovery system will yield two pounds of steam per pound of input refuse;
- With steam selling for approximately 41c per pound, the system output can be sold for approximately $2 per ton of incoming refuse;
- Back-up steam generation using fossil fuel would be required if steam were to be sold to a "captive" audience;

3. Municipal Incinerator With Add-on Electric Generating Equipment

- Capital costs estimated to be $14-$23 thousand per input ton of refuse;
- Total operating costs estimated at $12-$30 per ton;
- Two basic systems in development — a) steam to turn turbines and b) using waste gases directly to power turbine (an example is the CPU-400 system);
- The yield of either system should average 500-600 Kwh per ton refuse;
- A small pilot CPU-400 plant is currently being tested — the costs for this system are expected to average less than the steam system, but estimates may be unreliable;
- Refuse shredding and removal of glass and metals should add between $2 and $3 per ton to the total cost of refuse processing;
- *Assuming* 500 Kwh per ton refuse processed implies that the energy system would break-even @ 6 (the national average) mills/Kwh (or $3 per ton of refuse). However, energy rates currently range between 2.5 and 10 mills per Kwh, so system could only break even in selected regions.

4. Supplemental Fuel for Utilities Producing Electricity

- St. Louis pilot project uses one ton of refuse with 3-4 tons of coal;
- Refuse is shredded and magnetic materials removed;
- Capital costs in St. Louis range between $5 and $9 million (one or two processing units);
- Capital costs equal about $5 daily ton or $5 million for one unit to handle approximately 1000 tons per day;
- Operating and maintenance costs expected to run about $3 per ton;
- Total costs equal $5 per ton;
- Coal savings per ton refuse = $1.38;
- So net costs average nearly $4 per ton refuse burned;

It becomes evident from these examples that energy recovery yields a return just sufficient to offset the marginal cost of implementing the system. Even more important it has been estimated that the most efficient plant size for incineration is about 2,000 tons per day. This size would limit construction of efficient energy recovery systems to large urban communities with a population base of at least 750,000. There are only 31 geographical areas in the United States with populations this large. Table 35 indicates capital cost and capacity of different systems.

III. MATERIAL RECOVERY ALTERNATIVE

Two potential paths for materials recovery exist: the mixed refuse and the segregated refuse routes. The current status is that virtually all materials recovery follows the segregated refuse path where collection from industrial and commercial sources is carried on by independent waste dealers — usually dealing in only one type of material each.

A. Using Mixed Refuse[4]

1. *Automated Resource Recovery*

The path from mixed collection to materials recovery may follow the secondary market route of a resource recovery plant. To date, in this area only prototype plants have been built. Many technological problems still exist in both design and implementation. For example, the wet systems, typified by the Black-Clawson Fibreclaim system, produce output material (except for metals) of relatively low quality. Paper output is general is consistent only with the grades of waste paper used in construction papers or combination board. The recovered fiber could be up-graded to a bleached grade, but only with significant fiber loss and extra cost. In general, it appears that recovered paper fiber would be relegated to limited markets but would nevertheless be salable within geographic and quality limitations.

Dry fiber recovery systems are also still in the experimental pilot plant stage. In this type of system, waste would first be shredded and then separated out using a dry screen and air classifier. The current systems achieve very little recovery (less than 7 percent of the waste input) and are not expected to reach levels above 20 percent.

The economic problems associated with a comprehensive resource recovery plant, needless to say, are not well defined. This type of system would only be viable if both a steady supply of input materials is available and also a consistent demand for output exists. Because of the output quality, this latter condition will not be easy to satisfy. Table 35 indicates capital cost and capacity of different resource recovery systems.

As with the energy recovery systems, the total costs are dependent on the scale of operations and a heavy capital investment requirement. The Black-Clawson recovery process is estimated to require an investment of between $8,000 and $15,000 per daily ton[5] — depending on the plant capacity. Thus, a plant designed for 1,000 tons per day operations would require an investment of $10 million. Depending on plant

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[2] *A Study of Federal Subsidies to Stimulate Resource Recovery*, prepared by Resource Planning Associates, Inc. for the Environmental Protection Agency (Resource Recovery Division) Interim report, September 1972.

[3] The Chicago Northwest plant was constructed in an industrial park to attract industrial steam users. However, this plant required $23 million in capital to construct (1968 +)

[4] Source: *A Study of Federal Subsidies to Stimulate Resource Recovery*, prepared by Resource Planning Associates, Inc. for the Environmental Protection Agency (Resource Recovery Division), Interim Report, September 1972.

[5] Midwest Research Institute, Preliminary Draft of "Resource Recovery from Mixed Municipal Solid Wastes, Volume II."

Table 35

MATERIAL RECOVERY — INCINERATION PROTOTYPE PLANTS OR DEMONSTRATION PROJECTS

City	System	Capacity	Capital Cost
Franklin (Ohio)	Resource Recovery Plant Black-Clawson System*	150 Tons/8-hour day	$1.75M
Baltimore (Maryland)	Resource Recovery Plant Pyrolysis Unit — Monsanto System	1,000 Tons/day	$17M
San Diego (California)	Pyrolysis Unit — Garrett R&D System	200 Tons/day	$4M
Lowell (Massachusetts)	Resource Recovery from Incinerator Residue	250 Tons/day	$3.2M
Great Falls (Montana)	Pulverizer-Magnetic Recovery-Transfer Stations	40 Tons/hour	$ .7M
Braintree (Massachusetts)	Incinerator Facility	250 Tons/24-hour day	$2.5M
Fall River (Massachusetts)	Incinerator Facility	600 Tons/day	$6.2M
Hot Springs (Arkansas)	5 Small Incinerators (Consumat Units)	100 Tons/day 6-day week	
Harrisburg (Pennsylvania)	Incinerator with Steam Recovery	600 Tons/day 1 Shift 5 days week	$12.5M

*Estimates made by Black-Clawson:

200 Tons/8-hour day, capital cost	—	$2.9M
500 Tons	—	5.9M
1000 Tons	—	10M

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TABLE 36

CAPITAL INVESTMENT IN FOUR TREATMENT FACILITIES[1]

(To nearest $ 000)

a.	Processing equipment (conveyor belts, paper balers, magnetic separators, air separators, can bundlers, glass crushers)	$ 880,000
b.	Other equipment (scales, forklifts, front loaders, maintenance equipment)	320,000
c.	Land and building (land, site preparation, construction cost)	800,000
d.	Design and Engineering (10 percent)	200,000
	TOTAL	$2,200,000[2]
	Contingency (20 percent)	440,000
	Development costs (including development of performance specifications, operating procedures, site location and input-output requirements)	405,000

[1] Maximum capacity 1000-1200 tons per week (one shift)
[2] Basis used for depreciation.

capacity and depreciation assumptions, the processing costs should range between 6 and 11 dollars per ton. (The value of the recovered resources should average about $5 per input ton at current market levels.) The costs for a dry fiber plant are projected to be in the same general range.

2. Simple Resource Recovery

To date, in the area of resource recovery from mixed refuse, using simple processing only a small percentage of materials can be recovered. Only steel cans shredded and then magnetically separated are recoverable. No simple mechanical system exists to separate paper and/or glass from mixed refuse. Therefore, these simple systems cannot achieve recovery levels above 7-9 percent of the waste stream (the metallic content of the municipal waste stream).

An indirect method of resource recovery from mixed refuse is composting. Mixed waste is shredded and biologically broken down to produce humus and soil conditioner (see Appendix III, page 167). Large scale composting to be viable needs a market. Because so many of the variables associated with composting (e.g., composition, moisture content, market) depend on geography, it is difficult to conceive of a policy designed to stimulate composting on a state-wide basis.

B. Using Segregated Refuse — Recommended Alternative Summary Description

- Require mandatory source separation of paper and containers.
- Set up regional material treatment facilities to process recovered materials;
- Consolidate existing 53 "approved" landfills into regional sanitary landfills;
- Require these sanitary landfills to accept waste from 100 percent of population, and close all open dumps;
- Serve those who have no regional sanitary landfill or treatment facility within acceptable driving time through 20 regional transfer stations.

1. State level

Assumption: The economic analysis is based on total recovery of 125,000 tons per year (TPY) of materials, i.e., 40 percent recovery of present waste stream of 313,000 TPY.

Treatment Facilities
Table 36. Capital investment in treatment facilities
Table 37. Yearly operating costs of treatment facilities
Table 38. Flow of material into treatment facilities
Table 39. Contribution generated per treatment facility

Regional Sanitary Landfills
Table 40. Yearly operating costs of regional sanitary landfills

Transfer Stations
Table 41. Capital investment in transfer stations
Table 42. Yearly operating costs of transfer station network
Table 43. Hauling costs per minute per ton
Table 44. Yearly hauling costs

2. Regional level

An analysis of each region was made in order to take into account variations in waste generation, variations in composition, and structure of markets. The Northwest region will be considered in detail to provide a better understanding of the Plan and the methodology used.

Assumption: The economic analysis is based on current level of waste generation. The quantity of waste flowing through the Northwest region[6] is estimated at 330 tons per day (TPD) of which 130 TPD will be recovered and 200 TPD landfilled.

Treatment Facility — Northwest Region
Table 45. Revenue for Burlington Area Treatment Facility
Table 46. Contribution for Burlington Area Treatment Facility

Regional Sanitary Landfills — Northwest Region
Table 40. Yearly operating costs of regional sanitary landfills

Transfer Stations — Northwest Region
Table 47. Transfer costs associated with Northwest Region

Summary — Northwest Region
Table 48. Northwest Region — Income Statement

TABLE 37

YEARLY OPERATING COSTS OF FOUR TREATMENT FACILITIES [1]

a. Depreciation [2] (building and equipment)	$232,000
b. Labor [3]	320,000
c. Overhead (taxes, insurance, fuel, electricity, interest)	240,000
d. Repair and maintenance	68,000
TOTAL	$860,000

[1] excluding hauling costs between treatment facilities, transfer stations and landfills

[2] on straight line basis – 7 years useful life for equipment
15 years useful life for building

[3] 28 to 32 employees

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[6] The Northwest region is defined as the population served by regional landfills 1, 3 and 6 and the transfer stations directly or indirectly connected with the Burlington Area treatment facility (see Figure 2, supra, page).

Table 38

FLOW OF MATERIAL INTO TREATMENT FACILITIES[1]

(Tons Per Day)

Origin of Materials	Burlington Area	St. Johnsbury Area	Rutland Area	Springfield Area
	TREATMENT FACILITIES			
Shipped from Transfer Stations and Regional Sanitary Landfills	113	81	50	62
At Treatment Facilities	17	8	27	nil
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Components of Waste Stream				
Paper				
Cardboard	21	14	12	10
News	31	21	19	15
Low Quality Mixed	30	21	18	14
High Quality Mixed	16	11	9	7
Metal Containers	18	12	11	9
Glass Containers	14	10	8	7

[1] Based on total recovery of 125,000 tons per year.

Table 39

CONTRIBUTION GENERATED PER TREATMENT FACILITY TOWARD COLLECTION, TRANSFER COSTS AND DISPOSAL[1]

Dollars Per Processed Ton

	MATERIALS RECOVERED	BURLINGTON AREA	ST. JOHNSBURY AREA	RUTLAND AREA	SPRINGFIELD AREA	STATE AVERAGE
		TREATMENT FACILITIES				
PAPER	Revenue from Paper	13.90	13.45	14.60	14.90	14.00
	Processing Cost	4.75	7.00	8.10	10.10	6.90
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CONTAINERS	Revenue from Cans & Glass	10.90	10.00	11.85	11.90	12.30
	Processing Cost[2]	3.80	5.60	6.50	8.10	5.60
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[1] Based on 125,000 tons of material.

[2] All treatment facilities are assumed to have identical operating costs of $4,150,000 per week, of which $875,000 are associated with container processing and $3,275,000 with paper baling.

Table 40

OPERATING COSTS OF REGIONAL SANITARY LANDFILLS[1] WITH RESOURCE RECOVERY

	Area of Regional Landfill[2]	Population Served	RESIDUE TO BE SANITARY LANDFILLED by type of generator (Tons Per Year)				Yearly Operating Cost
			Urban	Rural	Transient	Total	
1.	Highgate	30,548	5,850	5,850	1,100	12,800	48,000
2.	Newport	29,439	1,800	8,750	1,450	12,000	45,000
3.	Colchester	101,853	27,400	14,250	2,200	43,850	99,000
4.	Lyndon	30,981	—	10,600	1,100	11,700	44,000
5.	Montpelier	52,568	14,250	6,200	3,650	24,100	72,000
6.	Bristol	23,034	4,750	4,000	2,550	11,300	45,000
7.	Castleton-Rutland	55,740	12,050	1,100	2,900	16,050	52,000
8.	Bennington	30,012	3,800	7,650	2,200	13,150	49,000
9.	Brattleboro	22,560	3,650	4,750	2,900	11,300	45,000
10.	Rockingham	29,303	3,650	6,950	4,000	14,600	51,000
11.	Hartford	38,693	—	13,500	2,900	16,400	54,000
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Operating Cost Per Ton Landfilled						$3.25

[1] Based on current level of municipal waste stream minus 125,000 tons of recovered material.

[2] Locations of the regional sanitary landfills are by no means definite or final—areas used in this table have been selected only for the purpose of analysis.

TABLE 41

CAPITAL INVESTMENT IN TWENTY TRANSFER STATIONS[1]

(To nearest $000)

a.	Building and Equipment (compactors, hoppers, front loaders)	$925,000
b.	Hauling equipment (containers, trailers, tractors)	825,000
c.	Design and Engineering	250,000
	TOTAL	$2,000,000 [2]
	Contingency (20 percent)	400,000
	Development costs (including development of performance specification, operating procedures and site location)	180,000

1 capacity varies between 5 and 25 tons per day

2 basis used for depreciation

TABLE 42

YEARLY OPERATING COSTS OF TWENTY TRANSFER STATIONS[1]

a.	Depreciation[2] (building and equipment)	$120,000
b.	Labor[3] (including 15% fringe benefits)	150,000
c.	Repair and maintenance	40,000
d.	Overhead (taxes, insurance, fuel, interest)	70,000
	TOTAL	$380,000

[1] excluding hauling costs between transfer stations, treatment facilities and landfills.

[2] on straight line basis - 7 years useful life for equipment
15 years useful life for building

[3] equivalent to 20 full time employees.

TABLE 43

HAULING COSTS[1]

a. 10 Ton Truck:
- direct hauling costs – $0.024 per ton per minute
- loading and unloading costs – $0.40 per ton

b. 20 Ton Truck:
- direct hauling costs – $0.014 per ton per minute
- loading and unloading costs – $0.31 per ton

[1] Because of varying traffic patterns all distances were measured in minutes travel time rather than miles.

Table 44

YEARLY HAULING COSTS[1]

Two basic options were considered using two different vehicles–10 Ton Truck and 20 Ton Truck. To evaluate cost trade offs among different distribution systems/treatment facility combinations, the following options were considered:

Option 1: treatment facilities are located at the sanitary landfill site

Option 2: treatment facilities and sanitary landfill sites are different.

OPTIONS	Yearly Hauling Costs	
	10 Ton Truck	20 Ton Truck
Option 1		
Hauling of Material	278,000	186,000
Hauling of Residue	146,000	106,000
TOTAL	$424,000	$292,000
Option 2		
Hauling of Material	288,000	193,000
Hauling of Residue	168,000	117,000
TOTAL	$456,000	$310,000

[1] Based on 112,000 tons per year of materials hauled to treatment facilities and 80,000 tons per year of residue hauled to regional sanitary landfills, see supra, page 3

Table 45

REVENUE FROM BURLINGTON AREA TREATMENT FACILITY

Materials Recovered	Tons Per Day	Dollars Per Ton[1]	Daily Revenue
Paper			
Cardboard	21	$19.00	399.00
Newsprint	31	11.00	341.00
Low quality mixed	30	5.00	150.00
High quality mixed	16	30.00	480.00
Total for Paper	98		[redacted]
Containers			
Metal	18	12.00	216.00
Glass	19	10.00	140.00
Total for Containers	32		[redacted]
Total for Materials	130		[redacted]

Estimated revenue per ton of:

Paper	$13.90
Containers	10.90
Materials	13.20

[1] Net price after shipping to market.

Table 46

CONTRIBUTION FROM BURLINGTON AREA TREATMENT FACILITY

Materials Recovered	Per Ton	Per Day
Revenue from Paper	$13.50	$1,370.00
Processing Cost[1]	4.75	475.00
[redacted]		
Revenue from Containers	$10.90	$356.00
Processing Cost[2]	3.80	126.00
[redacted]		

[1] Based on weekly operating cost of $3275.00 for paper processing.

[2] Based on weekly operating cost of $875.00 for container processing.

TABLE 47

TRANSFER COSTS ASSOCIATED WITH THE NORTHWEST REGION

As indicated in Table 38 out of the 130 TPD of materials recovered, 113 TPD will be hauled to the treatment facility from the regional sanitary landfills and transfer stations. Out of the 200 TPD landfilled, 46 TPD will be hauled to the regional sanitary landfills from the treatment facility and the transfer stations.

- OPERATING COSTS of Transfer Stations per day $415.00[1]
- HAULING COSTS per day

	10 Ton Truck	20 Ton Truck
Hauling of Materials	230.00	165.00
Hauling of Residue	100.00	65.00
TOTAL	$330.00	$230.00

---

[1] See Table 42, supra page 59

TABLE 48

NORTHWEST REGION INCOME STATEMENT

Per Day

a. Revenue from recovered material		$1,726
b. Expenses:		
Processing cost	$ 600.00	
Sanitary Landfill cost	530.00	
Transfer cost		
• operating	415.00	
• hauling[1]	330.00	
TOTAL	1875.00	
c. TOTAL operating revenue or (cost) of the Northwest Region system		(151.00)
Net operating cost[2] per ton of waste flowing through the Northwest Region (330 TPD)		($ 0.45)

---

[1] Most expensive hauling costs are assumed.

[2] Excludes profit to private enterprise and share of Solid Waste Programs Section operating cost.

APPENDIX II

ECONOMIC IMPACT OF MANDATORY DEPOSIT BILL

The so-called "Bottle Bill," passed by the 1972 session of the legislature, provides that a mandatory deposit on all beverage containers will become effective on July 1, 1973. This requirement could adversely affect the State Solid Waste Management and Resource Recovery Plan.

A mandatory deposit, or bottle ban is a device aimed at reducing litter. The deposit gives the container an economic value apart from the beverage. The empty container, then, should be valuable enough to the consumer to prevent him or her from discarding it. Even if the container is discarded, the deposit should still provide enough economic incentive for someone to collect it.

If such a deposit worked, very few beverage containers would be found in litter or in the municipal solid waste stream. At present, however, the effectiveness of mandatory deposits has not been established. All attempts to evaluate mandatory deposits have been inconclusive. Oregon implemented a deposit system in October 1972 and it is not expected that conclusive results of this program will be available until the summer of 1973.

Although the effect of a mandatory deposit system on *litter* is unknown, its impact on the *solid waste stream* can be evaluated. Table 49 summarizes the composition of the waste stream with and without a mandatory deposit system. Ninety-five percent of the 31,300 tons of glass in the annual Vermont municipal waste stream are containers. Approximately 50 percent or 50 to 60 million of the glass containers are beverage (beer and soda) containers.[1] Ninety-one percent of the metals in the municipal waste stream are also containers, but only 35 percent of the containers are beverage (beer and soda) containers.[2] There are currently approximately 90 million beverage cans in the municipal waste stream. Thus, the mandatory deposit system could eliminate most of the 140 to 150 million glass and metal beverage containers in the municipal waste stream, by promoting the reuse of the containers.

Two important questions must be answered in evaluating how the deposit will affect the beverage containers. Will the deposit force a conversion from one-way beverage containers to refillable containers? And how many round trips will a refillable beverage container make before it is discarded?

Although there is little information available to answer either of these questions it is believed that the long-term tendency would be for the container industry to abandon metal containers in favor of refillable bottles. However, the determining factor would be the number of round trips that a refillable beverage container would make before it is broken or discarded. The breakeven point is 4 to 5 round trips. If refillable containers make more than 4 or 5 round trips, their use becomes more economical than one-way containers. The most optimistic estimates indicate that nineteen round trips over a one year period are possible. Experience in Vancouver, British Columbia and in New York City indicated, however, that less than four trips were actually made. Nineteen round trips would result in a total conversion to refillable bottles. This would eliminate beverage cans and reduce the number of glass containers in the municipal waste stream by nearly 50 percent (see Table 49, page 157). The overall waste stream would then be reduced by 7 percent, from 313,000 tons to 292,000 tons.[3]

If the containers were making on the average only 2 or 3 round trips, they would most likely be composed of a mix of one-ways and refillables containers. Depending on this mix, the municipal waste stream may not be affected at all (predominantly one-way containers) or at most reduced 2 percent by weight (predominantly refillable containers making only 3 trips). Figure 24 presents the impact on the waste stream of a 100 percent effective bottle ban for different numbers of round trips. A mandatory deposit system may have a positive impact on littering but no significant impact on the municipal solid waste stream.

Even with the most optimistic estimates (19 round trips) the bottle ban would reduce the municipal solid waste stream only 7 percent by weight.

Resource Planning Associates' sole concern with the mandatory deposit system to become effective in Vermont centers upon its potentially adverse effect on the proposed State Solid Waste Management-Resource Recovery Plan. For this reason it is recommended that the effective date be delayed three years. It is felt that the added risks that would be introduced are not balanced by the potential benefits of reducing litter.

If the mandatory deposit system became effective, there

TABLE 49

WASTE STREAM COMPOSITION UNDER BOTH OPTIONS

	Without Bottle Ban (000 tons)	%		With Bottle Ban (000 tons)	%
Paper	131.3	42		131.3	45
Metal	28.1	9	– decrease 2.4% –	19.3	6.6
Glass	31.3	10	– decrease 3.3% –	17.3[1] 2.2[2]	6.7
Other material	18.7	6		18.7	6.4
Organics	75.0	24		75.0	25.7
Wood & Stone	28.1	9		28.1	9.6
TOTAL	313	100	– decrease 7% –	292	100

[1] from other containers: alcoholic, food, drug, cosmetics and other types of glass containers

[2] from discarded beverage containers

---

[1] *Glass Containers Edition, 1972.*

[2] *The Role of Packaging in Solid Waste Management, 1966 to 1976*, Midwest Research Institute, 1969

[3] The weight of glass beverage containers discarded can be calculated by the following mathematical model

$$Q = w_0 \times \frac{Y\# + X\#}{t_0} \times \frac{360}{d_0}$$

where Q = total weight of glass beverage containers discarded in tons under mandatory system

w_0 = average weight (in tons) of glass containers

$Y\#$ = number of metal beverage containers in circulation before ban

$X\#$ = number of metal beverage containers in circulation before ban

t_0 = average number of trips to market

d_0 = average useful life of glass containers in number of days

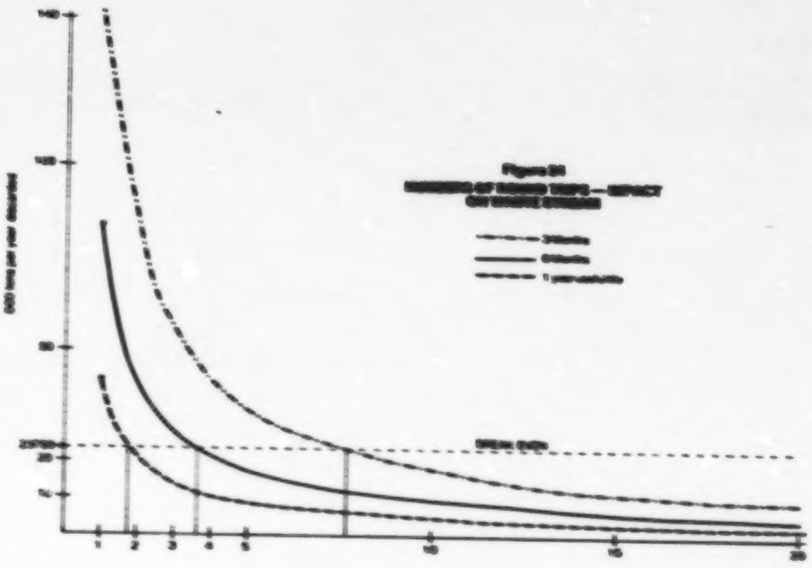


TABLE 50

MANDATORY DEPOSIT SYSTEM – REMAINING MATERIALS RECOVERY

	(000 Tons)	Available for Recovery %	Expected Max. Recovery %	Material Recovered (000 Tons)
Metal	19.3*	60	50	5.8
Glass	17.3*	60	35	3.6
	2.2*	90	50	1.0
Total	38.8*			10.4

*from Table 49, supra, page 62

would be three potential drawbacks: (1) effects on the material recovery "business," (2) overburdening the homeowners, and (3) reduction in the flow of materials and attendant reduction in economies of scale.

Material recovery is a significant component of the Plan. Materials are delivered to a treatment facility, processed, inventoried and shipped to market. The successful operation of any business depends heavily upon sound business relationships with the raw material suppliers and the customers. It would be an unwise business practice to set up a recycling business and at the same time impose a bottle ban which affects directly the customers of the recovered materials. At the extreme, markets could be closed to Vermont's recovered materials, especially since the State is only a small factor in overall national consumption. More realistically, the cooperation needed to get the material recovery operation off the ground will be absent, limiting the viability of the resource recovery portion of the Plan.

An important feature of the Plan is source separation. Evaluation of EPA's and other studies indicates that the simple separation scheme proposed in the Plan is practical and enforceable. However, the imposition of mandatory deposits would require additional separation of soda and beer containers. This additional level of separation could confuse or antagonize homeowners thus lowering the probability of compliance with the separation requirements recommended by the Plan (see supra, page 11).

The final potential effect of the mandatory deposit system is on the flow of materials. Glass and metal beverage containers are among the most easily accessible items in the municipal waste stream. Resource Planning Associates estimates that because of the increasing difficulty associated with the recovery of the materials remaining, only 10,400 tons per year out of the 38,800 tons per year in the waste stream would be recovered if the Plan was constrained by the mandatory deposit system.[4]

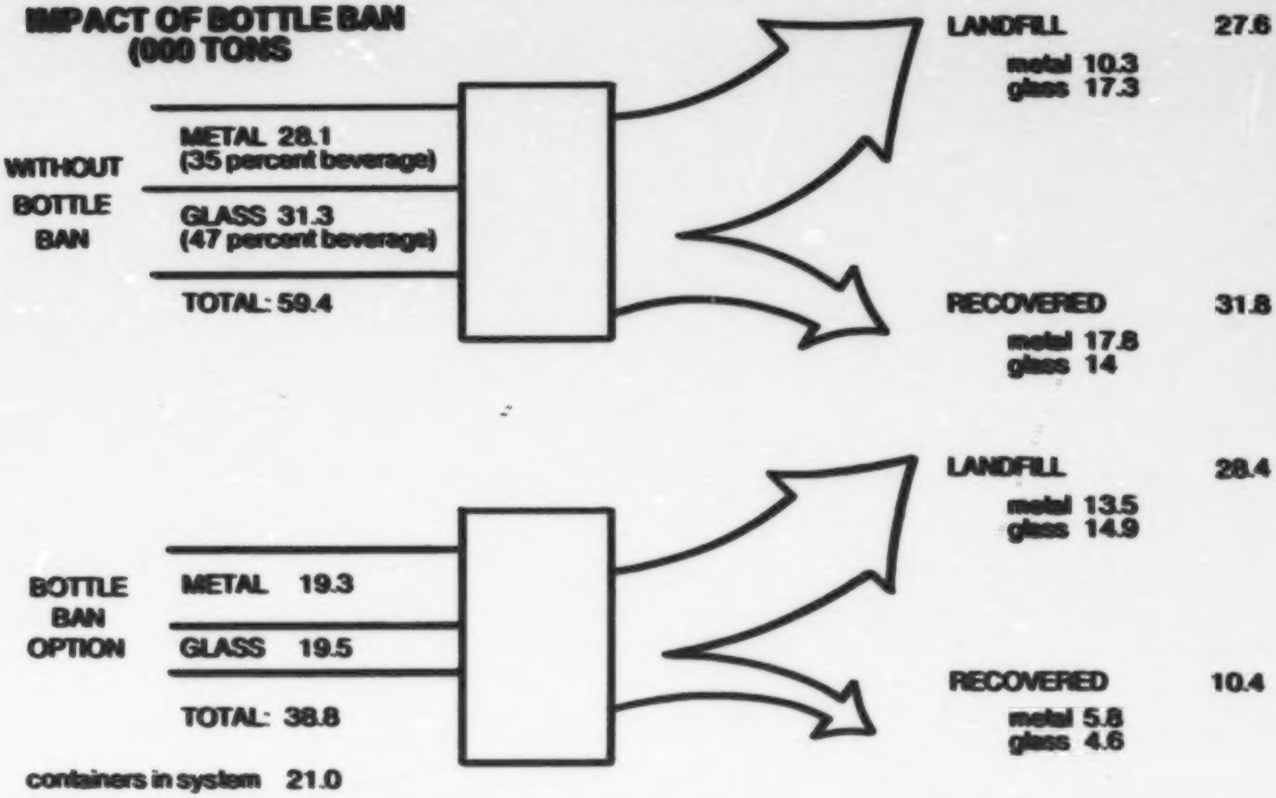
Figure 25 summarizes the impact of both options (the Plan *with* and *without* mandatory deposit) on the quantity of materials landfilled and recovered. As shown in Figure 25, it appears that the quantity of materials going into landfills could actually be slightly higher under the Bottle Ban Option than under material recovery (as recommended by the Plan) without bottle ban.[5] Thus, the Bottle Ban could, in effect, reduce the availability of materials for recycling, lower revenue and raise net costs. Table 51 summarizes this potential effect on revenues. Resource Planning Associates is not advocating a policy of increasing the amount of materials in the waste stream in order to make resource recovery plants more profitable. The concern is that the uncertainty created in the flow of materials might either delay implementation of the Plan or adversely affect the economics of resource recovery.

---

[4] *without* bottle ban it is assumed that 90 percent of the metal and glass are available for recovery. Seventy percent of the metal, and 50 percent of the glass, would be recovered (only clear glass would be recovered at this stage).

[5] It is assumed that the Bottle Ban is 100 percent effective and that 125,000 tons of materials are recovered under the Plan, without bottle ban.

Figure 25
IMPACT OF BOTTLE BAN
(000 TONS


WITHOUT BOTTLE BAN
METAL 28.1
(35 percent beverage)
GLASS 31.3
(47 percent beverage)
TOTAL: 59.4
LANDFILL 27.6
metal 10.3
glass 17.3
RECOVERED 31.8
metal 17.8
glass 14
BOTTLE BAN OPTION
METAL 19.3
GLASS 19.5
TOTAL: 38.8
LANDFILL 28.4
metal 13.5
glass 14.9
RECOVERED 10.4
metal 5.8
glass 4.6
containers in system 21.0

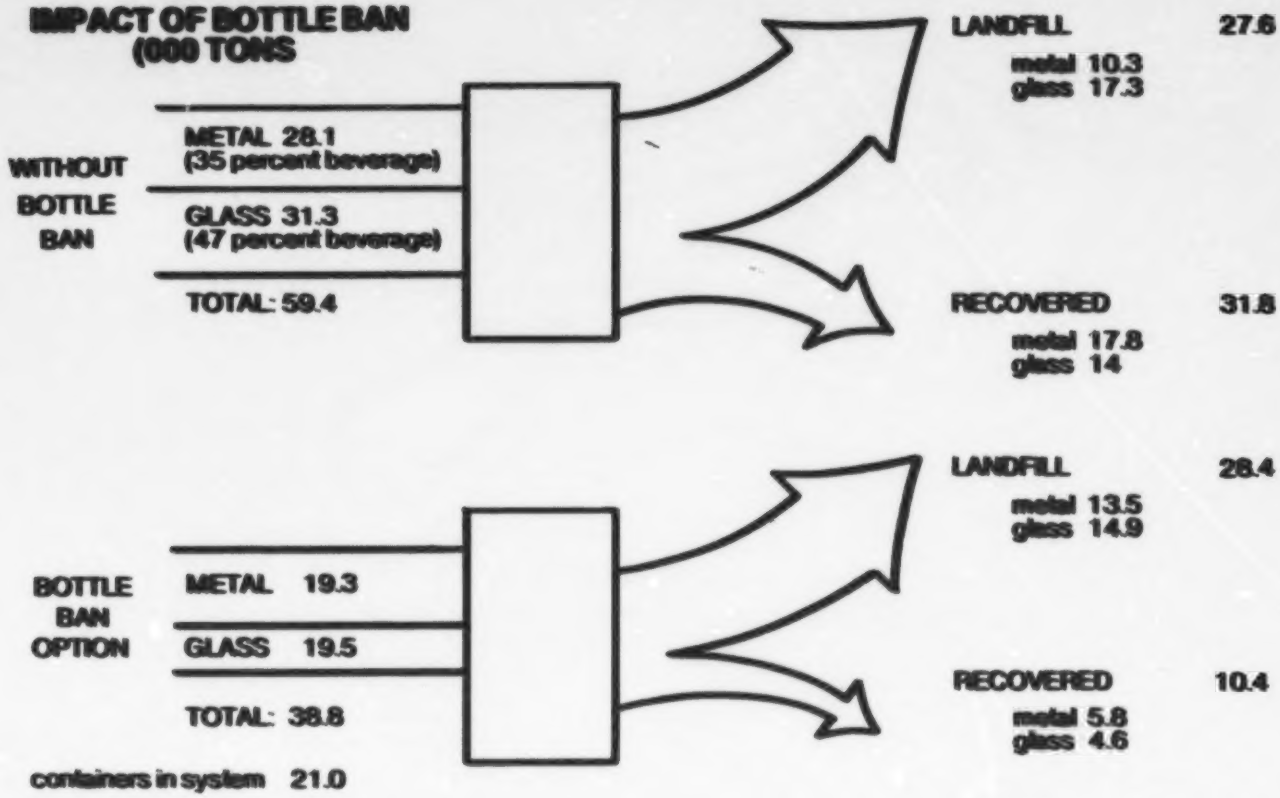
Resource Planning Associates, Inc.

Table 51
NET CONTRIBUTION PER TON UNDER DIFFERENT RECOVERY ASSUMPTIONS

	Assumption	Materials Recovered	Contribution
I.	Proposed System	Paper Containers	$2.10 .65
		[redacted]	[redacted]
II.	Proposed System with an Effective Bottle Ban	Papers Containers	$2.20 (.20)
		[redacted]	[redacted]
III.	Proposed System with Only Paper Recovery and an Effective Bottle Ban	Paper Containers	$2.20 —
		[redacted]	[redacted]

*Based on a 313,000 ton waste stream.
**Based on a 292,000 ton waste stream.

Figure 25
IMPACT OF BOTTLE BAN (000 TONS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		[redacted]	[redacted]
III.	Proposed System with Only Paper Recovery and an Effective Bottle Ban	Paper Containers	$2.20 —
		[redacted]	[redacted]

*Based on a 313,000 ton waste stream.

**Based on a 292,000 ton waste stream.

APPENDIX III
SOLID WASTE MANAGEMENT — LONG RANGE PLANNING

Outline of Appendix III

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III. Components of Total Treatment System	66
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The objectives of the long range system of solid waste management are:

1. To achieve additional reduction of the waste stream beyond the level of reduction achieved through mandatory domestic, commercial and industrial separation (see Table 52).
2. To minimize the capital and operating cost of such an operation.
3. To ensure that the system provides the maximum possible recovery of resources and achieves the "zero landfill concept."
4. To adapt the system to Vermont's characteristics by adopting a "regional" approach.
5. To allow for maximum flexibility to adapt to any changes in the Vermont solid waste stream.

I. LONG RANGE PLANNING

Vermont is faced with two major waste disposal problems: (1) domestic sewage and (2) solid waste. Added to these are a variety of problems related to special and industrial wastes. Most schemes of treating waste attack the problem solely from the aspect of disposal and consider the various components of waste disposal as separate problems. A modular system integrating various approaches to waste treatment has distinct advantages over conventional handling of the problem. Which subsystem will be most applicable for a given region of the State will be determined by information relative to the following parameters:

1. Nature of the present and future sewage system (capacity, type of operation, location).
2. Potential uses for methane, compost, clean fill or other resources.
3. Special waste problems unique to the region (which may require special pretreatment or modules).
4. In-depth study to determine optimum location for the various component subsystems. Allowance in the system for the addition of modules if and when technology becomes available, or market demand makes possible further separation of materials.
5. Land availability for the treatment facilities. This is especially important in the design of the composting subsystem. Where land is limited, the closed system (tubular or digester) composting system may be most applicable. Where land is not limited, the windrow type system may be best.
6. Economic realities within the region. In most cases, economic realities will initially prevent the utilization of all available technology. By designing a viable and modifiable modular system unexpected changes and additions to the waste stream may be accounted for.
7. Incineration, and other forms of treatment which require large capital investment must be carefully analyzed to insure that they will be acceptable parts of the system. All modules must be designed with the long term objectives of minimum residue and maximum resource recovery.
8. Any system of resource recovery must be able to compete with virgin materials for markets. The long range system must be able to insure a constant quality and quantity of materials or other resources if they are to compete. The best way to insure this is regionalization which takes advantage of varied economies of scale.

It is quite conceivable that the various components in the total system may not be located in the same area. For example, in a region consisting of many small communities, some of the steps may be advantageously located within the communities, while other steps may be centrally located within the region. Such a design should take advantage of the minimum haul distances available for the local community, and take advantage of the economies of scale available for the regional approach. The activated sludge treatment, methane generation, refined technical resource recovery and composting may be better handled at a central location within the region, where economies of scale can be important.

In the design of such a total concept system, the advantages of the various subsystems and their location must be carefully weighed and trade-offs made to insure greatest efficiency, at least cost with maximization of the economies of scale, constant supply and large quantities needed for marketing of segregated recovered materials. Such a total design will require detailed market analysis as well as detailed technical studies within the proposed region. The revenue derived from the sale of the

Table 52
WASTE REMAINING FOR FURTHER PROCESSING IN 1980[1]

Components of Waste Stream	Percentage	000 Tons
Paper	20	57
Cardboard	1	3
Newsprint	4	11
Other	15	43
Metal	3	9
Glass	4	11
Plastics & Leather	4	11
Textiles	3	9
Rubber	2	6
Organics	47	133
Wood & Stones	17	48
TOTAL	100	284

[1] Estimated Waste Stream of 284,000 Tons in 1980. (60 percent of 474,000 Tons)

segregated wastes will be turned back to the region to reduce the cost to the communities for the treatment of waste. In the event that the region is able to make a profit, this could be returned to the individual communities on a pro-rated basis to reduce the local tax burden.

Another advantage of the total waste system concept is that the sewage treatment facilities and the central solid waste treatment subsystems may be located in the same area, (in fact, it is desirable to do so) thereby reducing the siting problems which presently plague solid waste management organizations.

II. VERMONT'S LONG RANGE SOLID WASTE MANAGEMENT SYSTEM

Figure 26, using a simplified flow diagram, illustrates how the integrated modular approach would operate in Vermont. Before discussion of the various components, an overview of the entire system is desirable.

The solid waste stream consist of a heterogeneous mix containing paper, glass, metals, garbage, etc. The first treatment step in this system is source separation of selected fractions, as discussed earlier in this report. Using this method up to 40 percent by weight of the solid waste stream could be removed.

At this point, garbage can be segregated and hauled directly to the waste treatment facility, ground and mixed with the domestic sewage stream. Instead of segregation, the garbage can be ground in household garbage grinders and mixed with the sewage stream. This system of garbage grinding uses the sewage lines to transport the garbage and can reduce the solid waste pickup by up to 24 percent. Following in-home segregation and garbage segregation and//or grinding, the solid waste stream is subjected to a series of mechanized steps to remove some of the remaining magnetics and other feasibly separated components.

By a combination of household sorting and simple separation technology, (including magnetic separation, flotation and air classification) it should be possible, in a well-designed system, to remove up to 50 percent of the solid waste by weight at this point.

The remaining solid waste stream consisting of other organics (including lawn clippings, dead animals, unseparated garbage, etc.) and any unreclaimed materials (such as small glass particles, etc.) then goes to a mixing and grinding step where it is mixed with the sewage sludge as a preparation for composting.

The sewage flow either enters home septic tanks (which must be increased in capacity if garbage grinding is practiced) or enters the waste treatment plant where it is mixed with the ground garbage. Special and industrial wastes may also enter the waste treatment plant, following special pre-treatment steps to remove any especially troublesome wastes. Pretreatment steps may include equalization, neutralization, oil separation and sedimentation. Following pretreatment, the special and industrial wastes can be added to the waste flow, providing they are compatible with the system. The sewage and solid waste organics are treated in a plant which is similar, in most respects, to a conventional activated sludge system. Such a system is perfectly capable of treating sewage and solid waste organics provided that the capacity is increased to take care of the increment due to solid waste. This component consists of the following sub-systems: neutralization, sedimentation, activated sludge, digestion, thickening and vacuum filtration. The effects due to the addition of solid waste to sewage are discussed under garbage grinding and methane generation.

Following digestion, the water evolved can be used as irrigation water or submitted to tertiary treatment steps including filtration, exchange and carbon absorption to further purify the water before it is added to the environment.

The sludge from the digestor is mixed with the remaining solid waste stream and the mix is ground or shredded as a prelude to composting. The mix is then composed in closed system composters or in windrows. Following composting, the mix is screened to separate the remaining non-organics from the organics. The organics at this point constitute a humus-like soil conditioner which can be bagged and sold, given away or used as a soil conditioner on public lands, such as parks and play grounds. The small glass fragment and other non-organic impurities increase the quality of the product as a soil conditioner. The non-organic fraction may be subjected to a final resource-recovery step to remove any remaining marketable materials and the tailings that remain are suitable as clean fill, or can be used in various subsidiary industries such as manufacture of composition bricks or tiles.

The components of the initial integrated system include: source separation, mechanical resource recovery, garbage grinding, conventional activated sludge waste (sewage) treatment, methane generation, composting and source reduction. These component subsystems will now be discussed in detail.

III. COMPONENTS OF TOTAL TREATMENT SYSTEM

A. Source Separation

Domestic, commercial and industrial source separation has been discussed in detail earlier. This subsystem is capable of removing 40 percent of the solid waste with minimum expense, and as such constituted the ideal first step in the Vermont system and can be initiated immediately.

B. Garbage Grinding

Garbage is ground in the home and in its broken-down form is flushed into the sewage system.

Garbage comprises 24 percent of solid waste by weight. When used by every householder in an area large enough to justify change in refuse collection, maximum savings in refuse collection costs are possible. Separate collection of garbage can be discontinued, or limited to restaurants and other food-handling establishments. When combined collections are made, it may be possible to reduce significantly the frequency of collecting remaining refuse and thus decrease the per-capita cost.

According to Carpenter,[1] the increases expected in sewage load, due to garbage grinding, would amount to .5 pounds per capita, with a variation as high as 50 percent. The high point occurring during the summer when green vegetables are plentiful. Garbage grinding increases the flow of sewage by 1 or 2 gallons per capita per day (approximately 1 percent to 2 percent increase). The BOD, suspended solids and grease will show significant increase. Hazeltine[2] estimated that this could increase BOD up to 50 percent and fats and greases by 60 percent. Zimmer[3] reported, after intensive testing, that the use of garbage grinders should introduce no difficulties in plumbing installations.

Ground garbage has essentially the same specific gravity as the constituents found in ordinary sewage and few new materials are introduced. Normal domestic sewage is so dilute that even at 30 percent to 50 percent increase in suspended solids, there is no increase in deposits following garbage grinding. Studies at Jasper, Indiana indicate that sewers were in better shape after communitywide installation of household garbage grinders than before because the roughage tends to scrub out the system.

The addition of ground garbage to sewage has a more marked effect on sludge digestion than any other part of a sewage treatment plant. The mixture of garbage and sewage digests as readily as sewage alone. In fact, garbage breaks down so readily that the rate of digestion has been found to increase. Also, the formation of acid conditions is prevented somewhat by addition of garbage which increases efficiency. Increased digester capacity is required. When all of an area's garbage is ground, the digester capacity may almost double. Five cubic feet per capita of digester capacity is required for primary sewage solids and garbage and 9 cubic feet per capita for primary and secondary sewage solids and garbage.

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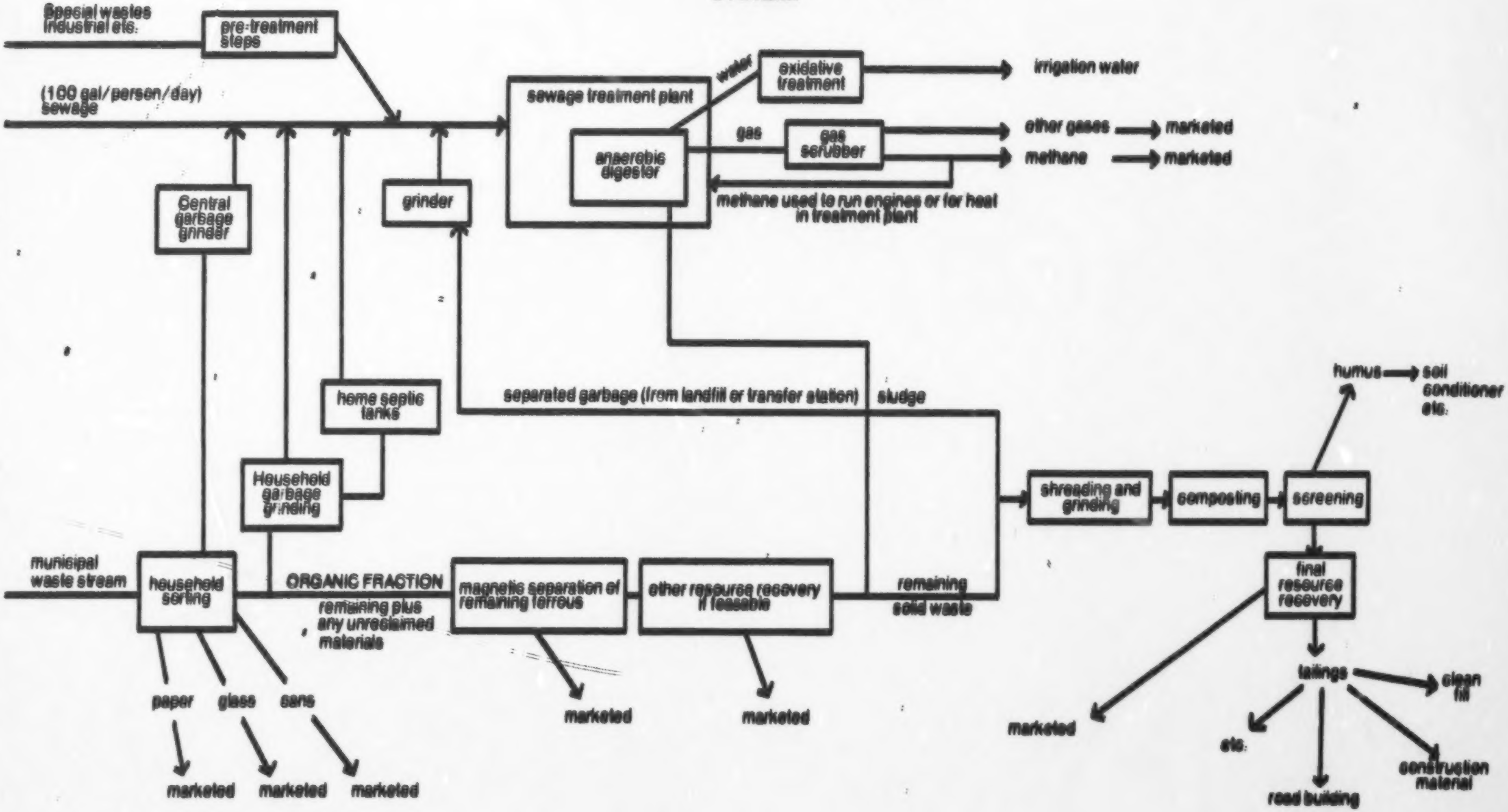
[1] Carpenter, L. V., R. C. Ragsland and B. Grabois, "The Disposal of Garbage in the Sewage System," Sewage Works Journal, 8: (5) 728, 1936.

[2] Hazeltine, T. R., "Addition of Garbage to Sewage," Water and Sewage Works, Reference and Data edition 102 R, R-308, 1955.

[3] Zimmer, E. J., "Effects of the Use of Food Waste Disposers on Household Plumbing Installations," page 5. Public Works Engineers' Special Report No. 13, American Public Works Association, Mimeo: 32 pp., 1951.

Figure 28

VERMONT'S LONG RANGE SYSTEM-FLOW DIAGRAM OF MODULAR WASTE TREATMENT SYSTEM.


Special wastes industrial etc.
pre-treatment steps
(100 gal/person/day) sewage
sewage treatment plant
anaerobic digester
water
oxidative treatment
irrigation water
gas
gas scrubber
other gases
marketed
methane
marketed
methane used to run engines or for heat in treatment plant
Central garbage grinder
grinder
home septic tanks
Household garbage grinding
separated garbage (from landfill or transfer station)
sludge
municipal waste stream
household sorting
ORGANIC FRACTION
remaining plus any unreclaimed materials
magnetic separation of remaining ferrous
other resource recovery if feasible
remaining solid waste
paper
glass
cans
marketed
marketed
marketed
marketed
marketed
shreading and grinding
composting
screening
humus
soil conditioner etc.
final resource recovery
marketed
tailings
clean fill
etc.
road building
construction material

C. Methane Generation from Sewage and Solid Waste

When ground garbage is added to domestic sewage the gas produced will increase as high as 100 percent. No difficulties have been reported using this gas in operating gas engines, so that the use of increased quantities of gas may help offset the increased costs of handling garbage solids. In addition, this gas can be marketed.

Organic waste is spontaneously converted into methane in the absence of oxygen. No additives are required and between 50 percent and 80 percent of the organic matter is transformed into volatile products consisting of approximately 70 percent methane, 30 percent carbon and small amounts of other gases. The gases would have a relatively high boiling point and could readily be removed by chemical scrubbers and cold traps. The increased sludge due to solid waste addition might extract much of the nitrogen and phosphate from sewage water and would decrease the contribution of sewage to water pollution. It could be combined with compost for use as a soil conditioner.

Methane gas is a renewable energy source readily accessible to the place of use. Its use involves no change in the consumers' combustion equipment. It could be used as natural gas is now used, or in the new fuel cells presently under development, such as the Target fuel system to heat and provide electricity for homes or other uses.

D. Conventional Activated Sludge System

The use of activated sludge to remove soluble biodegradable organic matter is probably the predominant sewage treatment process. Many plants utilize such systems and report performance levels of 88 percent BOD removal. When using the activated sludge process, the wasted sludge is first aerobically digested, then thickened and dewatered by vacuum filtration. In most current plants, the sludge is then disposed of in landfill. In the proposed modular system, the sludge would then go to the final composting step.

E. Composting

Waste is biologically broken down to produce humus and soil conditioners.

Composting developed 25 years ago in Europe. While there were many composting processes, two major types of plants predominated: the rasping system-windrow composting plants developed by the Dutch and the Dano biostabilizer developed by the Danes.

Some examples of composting plants presently available include the Geochemical Corporation Digester System with a capacity of up to 35 tons per day of waste. This apparatus consists of a tube 11 feet in diameter and 120 feet in length. The process takes three days and turns out a sanitary humus. Sewage sludge or raw sewage can be added to promote bacterial activity. After 12 hours, the temperature is up to 150° and in 24 hours, up to 170° which kills all pathogens and weed seeds. After coming out of the digester, the compost is screened to separate remaining inorganics. Any remaining glass, ceramics and plastics can be ground into particles and used as conditioners or fillers to improve soil quality. The finished product can be used for landfill, surface dressing or, in limited situations, bagged for sale. The tailings of undigested material are sterile and highly compacted and can be used as clean fill.

Use of chemical fertilizers produces good yields, however, the condition of the soil deteriorates and the amount of organic matter decreases. This leads to prevention of sufficient water percolation and storage during dry periods. Nitrogen is lost by leaching or denitrification. Furthermore, substantial crop-yield can result from the sole use of compost. Oats, potatoes and rye, increased an average of 11.4 percent over a nine-year study as compared to products given equal amounts of nutrients in the form of chemical fertilizers. Compost may be spread and farmed at rates of tens to hundreds of tons per acre per year, depending on soil conditioning.

For these reasons and others outlined below, composting is seen as the ideal *final* treatment step in the Vermont comprehensive management plan. The major reason for failures in American compost design has been the attempt to rely on the sale of compost and salvaged materials for their primary income, with only a nominal payment by the municipality for disposal. This is totally unrealistic. Composting, to be viable, must be, at least initially, tax supported *like all other methods of treatment*, such as incineration and landfill. When viewed this way, composting at $5 and $10 per ton competes favorably with more established treatments (i.e., incineration).

In normal composting, the aerobic thermophilic decomposition produces temperatures of 140°F or higher for several hours or even days. Such a "time-temperature factor is believed to be adequate to destroy most, if not all, pathogens. Reports by Knoll, Wiley and Krige on European and South African studies have consistently indicated the safety of composts, produced by a number of processes. Several reports indicate that antimicrobial substances produced in composting may be as important as time-temperature in destroying pathogens. Compost produced from refuse-sludge mixtures is far less likely to contain viable pathogens and seeds than normally digested sewage sludge.[11]

Composting has low quantities required — for Vermont, as low as 4 tons (see chart) and as high as 300 tons.

One important danger, which will require careful monitoring of compost, is the presence in some wastes of heavy metals that are potentially toxic. In neutral or alkaline soils, the heavy metals are tightly bound by soil colloids and hence are not readily available to plants. However, since some soils are acid, this problem should not be ignored and monitoring of wastes and compost should be carried on. This could require some control methods to eliminate some wastes. For example, codes (such as the U.S. Municipal Codes) should be adopted, forbidding the use of sewers for disposal of mercury or hydrocarbons in wastes.

F. Other Possible Subsystems

In this type of modular approach, other treatment modules can be added, if applicable for a given need, in the total waste management design for a region. Wood chipping may be used as an early system module if there is a large need for wood chips, for instance, as mulch by the Park Department. A hammermill or other large reduction apparatus may be included for treatment of automobiles, refrigerators and other large items. Such a modular system should thus be adaptable to the Vermont situation, and additional modules can be incorporated at any time should the need develop or new technology make additional steps feasible.

G. Source Reduction

As a corollate of any design system, source reduction should be utilized to eliminate from the solid waste stream materials which do not degrade (non-organics) and for which there is no potential for reclamation, recycling or alternate uses. As a corollate, certain types of materials should be regulated to increase the efficiency of the system.

It is suggested that a study be conducted to identify those materials which lack sound justification for continued existence so that they may be replaced by other materials and eliminated entirely.

IV. ECONOMIC ANALYSIS — PROJECTIONS

The total capital costs for the State on Vermont for sewage treatment would be approximately $17,800,000, with a Statewide operating budget of between $4 and $5,000,000. This would provide the entire State with activated sludge systems. The total capital cost for a particular treatment system may be calculated by adding the unit cost of each process included in the system and to this total, adding 35 percent to cover the costs of piping, pumping, engineering and other contingencies.

The capital cost increment from garbage grinding for the State would be $278,000 or approximately 2 percent of the total capital cost of sewage treatment. This must be considered in light of substantial savings in garbage haul costs, especially since without garbage fraction waste pickup schedules can be designed optimally to utilize men and vehicles in a rotation schedule of fraction pickup. Other savings will result from the reduced need for further treatment of garbage and increased efficiencies in the sewage treatment facilities.

On the basis of the organic fraction, 10 cubic feet of gas is produced for every pound of waste. One ton of dry organic matter produces 20,000 cubic feet of methane worth from $3.40 to $6.60, at current wellhead prices of 17¢ per thousand cubic feet. (The Chicago price, before distribution, is 33¢; New York City, 45¢.) Thus the potential methane generation for Vermont is approximately 600,000,000 cubic feet worth about $100,000. As a by-product, the one-half ton of sludge containing $1 worth of plant nutrients, twice the nutrient concentration of the original waste. This can then be composted to yield high-grade soil conditioner and fertilizer.

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[11] Wiley, J. S., F. E. Gartrell and H. G. Smith, "Concept and Design of the Joint U.S. Public Health Service — Tennessee Valley Authority Composting Project, Johnson City, Tennessee," Compost Science, 7(2): 11-14, 1966.

Total cost of separating and grinding organic solid wastes and digesting in existing sewage digesters is estimated to be:

Tons Per Day	Population	Cost Per Ton
45	30,000	$5.26
450	300,000	$3.05
1,500	1,000,000	$1.87

The value of the recovered methane (assuming a wellhead price of 17¢ and a before distribution price of 48¢ per thousand cubic feet) is $9.60 per ton of refuse. Gas from newly developed fields is expected to have a wellhead price of 25¢ per thousand cubic feet.

Relatively inexpensive modification of existing or planned treatment plants would provide a means to recover inorganic and handle a large part of the organic wastes of a community. The estimated cost of treatment for garbage alone, following grinding is between $5 and $10 per ton of garbage.

The estimated availability of this system is less than one year for existing systems since auxiliary equipment is commercially available. However, cost restrictions will probably dictate acquisition over a number of years.

Composting costs are variable and not uniformly derived. The Dutch compost up to 17 percent and use the compost to reclaim land in the North Sea. Capital costs range from $0.55 to $1.91 per ton for windrow plants and from $1.18 to $3.98 per ton for digester plants. Operating expenses run from $1.51 to $2.76 per ton with estimated revenue from compost up to $10 per ton.

The Geochemical Corporation Digester System costs are estimated at between $4 and $5 per ton of humus. Ames, Iowa has puchased one and Westport and Ridgefield, Connecticut, are considering purchase. All American Environmental Control Corporation is marketing a windrow-type operation with a cost estimate of approximately $5 to $10 per ton, depending on the situation. The Ecology, Inc. Plant in Brooklyn, New York, is a closed system digester-type plant with a 150 ton per day capacity. Hercules, Inc. is presently designing a 500 tons per day to 230 tons per day plant which will include sewage sludge in its treatment. The Ecology, Inc. costs run around $15 per ton and the Hercules plant between $7 and $10 per ton.

V. IMPLEMENTATION OF THE VERMONT TOTAL TREATMENT SYSTEM

Implementation of the Vermont system is suggested to start immediately. It is emphasized that this system is dynamic and will take several years to evolve to full status and efficiency. In addition the Solid Waste Programs Section must continue to monitor the Vermont solid waste stream to detect any changes so that corresponding modifications in the system may be implemented. Ongoing market analysis and technical analysis of the resource recovery techniques must also be performed and additional modules added as they become feasible and out of date modules phased out.

Immediate steps should be taken to determine the status of present sewage systems and plans for new treatment facilities within Vermont and to assess their adaptability to the treatment of solid waste. Where necessary, increases in capacity must be planned.

The utilization of sewage treatment plants to treat garbage can be initiated immediately where plants are presently able to accept the addition of garbage without extensive modifications. In some cases this may only require the addition of a central grinding station.

The garbage fraction can be mixed with the sewage flow in four places:

1. Via in-home garbage grinders.
2. Via separate pickup with central grinding.
3. Via grinding following separation by technical means such as wet slurry.
4. Via grinding following segregation at landfill site.

It is suggested that the best alternative if available is to utilize household garbage grinding. As an alternate, separate garbage pickup with central grinding is desirable. The conversion from one system to the other can be gradual and effected over several years.

The encouragement and eventual requirement of in-home garbage grinders is suggested to take place as soon as possible. The conversion to garbage grinding is suggested to coincide with the elimination of any existent open sewers in conjunction with water pollution control operations and the installation of municipal sewage systems and/or individual septic tanks. When such systems are designed, the added load necessitated by garbage grinding should be included in the design capacity of the sewage treatment plant and/or septic tank. The sewage treatment plant where one is proposed can be designed to take advantage of the gas generated in treatment (methane) as a marketable product (see previous discussion), where garbage is not ground, it and other organic fractions may be added at the sewage treatment plant.

Chippers should be immediately installed at several of the existing landfill sites. The woodchips can be used by local and State conservation agencies or given to the people for use as mulch.

Where sewage sludge or garbage is presently available composting operations should be initiated and a comprehensive analysis made of compost for governmental, agriculture, commercial and domestic use. The encouragement of the use of compost as a soil conditioner should be stressed and acceptance of compost by agriculture encouraged. Specialty uses such as "organic" gardening should be encouraged.

Solid Waste Management Regions should be established and additional magnetic separation initiated within 3 years in all regions. Within the next 5 years hammermills or other large reduction apparatus should be installed in all regions. Within 10 years the basic system should be operational with a minimum amount of residue remaining for landfill. From 1990 on the major task of the Solid Waste Programs Section will be the analysis of the waste stream and the addition of modules. In general the next 5 to 10 years will consist of a general tightening of the system to increase efficiency with cost and residue reduction. By 1995-2000 this system should approach Zero-landfill.

This Section must also undertake the following tasks:

1. Development of markets and/or subsidiary industries to utilize tailings.
2. Encouragement of agricultural and domestic use of compost.
3. Siting of the various subsystems as they are implemented to utilize maximally each component.
4. The development of markets and a distribution system for methane.
5. Initiation of an in-depth study of all components of the solid waste stream to identify materials that do not degrade and for which there is no potential for reclamation, recycling or alternate use, and the elimination or replacement of such materials by various means.
6. Evaluation and monitoring of total treatment system to increase efficiency and reduce costs.
7. Adopt codes forbidding the use of sewers for the disposal of toxic and hazardous wastes such as cadmium, mercury and hydrocarbons.

APPENDIX IV
TASKS AND SKILLS REQUIRED TO IMPLEMENT THE PLAN

TABLE 53
RESOURCE RECOVERY
(Resource Recovery Unit)

Responsibilities	Tasks	Skills Required
1. Contract with end users.	1. Develop model contractual agreements.	1. Secondary material, legal expertise.
2. Implement resource recovery system.	2. Provide model ordinances to support State action.	2. Legal, policy making.
3. Monitor on-going resource recovery system.	3. Develop program for mandatory domestic, commercial and industrial separation of papers and containers.	3. Managerial, policy making.
	4. Enforce mandatory separation.	4. Police, control.
	5. Develop performance specifications and operating procedures treatment facilities.	5. Engineering, managerial.
	6. Acquire site for first Treatment Facility.	6. Managerial.
	7. Construct pilot Treatment Facility in Burlington area.	7. Architectural, engineering, construction management.
	8. Operate pilot Treatment Facility in Burlington area.	8. Operational management.
	9. Inspect and enforce quality control standards for collection, transfer and processing of recovered materials.	9. Secondary material expertise, control.
	10. Assist in operation of resource recovery system.	10. General management, technical.
	11. Evaluate pilot Treatment Facility operation.	11. Engineering, managerial.
	12. Manage bulky metallic waste recovery program.	12. Secondary material expertise.
	13. Define and evaluate additional waste reduction alternatives.	13. Engineering, business, economic, marketing.
	14. Apply for demonstration grants and other financial support.	14. General management, technical.
	15. Coordinate program with other units.	15. General management.
	16. Insure completion of resource recovery system.	16. General management.
	17. Monitor on-going resource recovery activity.	17. General management, secondary material expertise, control.
	18. Collect and monitor information.	18. Managerial, technical.

TABLE 54
COLLECTION AND DISPOSAL
(Surveillance and Enforcement Unit)

Responsibilities	Tasks	Skills Required
1. Implement regionalization of sanitary landfills.	1. Locate sites throughout the State for sanitary landfills and regional transfer stations.	1. Site selection, systems engineering.
2. Implement transfer station system.	2. Close existing dumps and work out temporary disposal agreements throughout State.	2. Sanitary engineering, pest control, knowledge of local structure.
3. Monitor collection and disposal systems.	3. Work out location agreements for regional sanitary landfills.	3. General management.
4. Monitor special waste problems.	4. Develop disposal procedures for special wastes.	4. Sanitary engineering.
	5. Develop performance specifications and operating procedures for sanitary landfills and regional transfer stations.	5. Engineering, managerial.
	6. Develop model sanitary landfill operation agreement.	6. Legal, sanitary engineering.
	7. Inspect and enforce sanitary standards for collection and disposal of residue.	7. Sanitary engineering, control.
	8. Construct pilot transfer station.	8. Architectural, engineering, construction management.
	9. Operate pilot transfer station.	9. Operational management.
	10. Apply for grants and other financial support.	10. General management.
	11. Insure completion of Transfer Station System and monitor on-going system.	11. General management.
	12. Insure regionalization of landfill and monitor on-going disposal activity.	12. General management, sanitary engineering.
	13. Evaluate pilot transfer station and regional sanitary landfill operations.	13. Engineering, managerial.
	14. Collect and monitor information.	14. Managerial, technical.

TABLE 55

TECHNICAL SUPPORT

(Technical Support Unit)

Responsibilities	Tasks	Skills Required
1. Assist local communities.	1. Aid local units in developing operational and organizational programs for private haulers: • evaluate franchising in service areas; • develop and evaluate collection techniques for separated wastes; • develop new collection truck routes; and • evaluate fee structure.	1. Managerial, systems engineering.
2. Insure public information.	2. Aid local units in any matter related to solid waste management.	2. Managerial, sanitary engineering, legal, financial.
3. Implement training programs in conjunction with resource recovery and disposal.	3. Develop training programs in conjunction with other solid waste units (Resource recovery and surveillance and enforcement units).	3. Public relations.
	4. Develop public information programs.	4. Managerial, technical.
	5. Collect and monitor information.	5. Managerial, technical.

APPENDIX V

DIGEST OF MAJOR SOLID WASTE REGULATIONS IN VERMONT

VERMONT STATUTES ANNOTATED

TITLE 24

MUNICIPAL AND COUNTY GOVERNMENT

Chapter 51

Subchapter 8. Rubbish and Garbage

§ 2201. Throwing, depositing and dumping refuse, penalty

a) A person shall not throw, dump, deposit or cause to be thrown, dumped or deposited, bottles, glass, crockery, cans, scrap metal, junk, paper, garbage, old automobiles, or parts thereof, refuse of whatever nature, or any noxious thing on lands of others or within 300 feet of the lands of others, public or private, or into the waters of this state, or on the shores or banks thereof or on or within view of a public highway.

b) A person who violates a provision of this section shall be fined not more than $500.00 or imprisoned not more than ten days, or both. If the throwing, placing or depositing was done from a motor vehicle, except a motor bus, it shall be prima facie evidence that the throwing, placing or depositing was done by the driver of such motor vehicle. Nothing in this section shall be construed as affecting the operation of an automobile graveyard or junkyard as defined in section 2241 of this title, nor shall anything in this section be construed as prohibiting the installation and use of appropriate receptacles for solid waste provided by the state or towns. Sanitary landfills, recycling centers, and incinerators maintained pursuant to section 2202 of this title; and solid waste from mining, quarrying, farming operations, or logging and sawmill operations are exempt from the restrictions set forth above concerning the distance of 300 feet and visibility from a public highway.

c) A person convicted of a violation of this section may work a total of not more than forty hours collecting trash or litter from roadsides or other public property under such supervision as the court may direct in lieu of a sentence if the court, in its discretion, so permits.

d) The commissioner of motor vehicles shall suspend the motor vehicle operator's license of a person convicted under this section for a period of ten days if the court finds that the person convicted was the operator of a motor vehicle at the time of the violation. This provision shall not apply if the only evidence of violation is the presumption set forth in subsection (b). The court shall immediately notify the commissioner of the department of motor vehicles of the conviction.

e) The commissioner of fish and game shall revoke the privilege of a person convicted under this section from holding a hunting or fishing license, or both, for a period of one year from the date of conviction, if the court finds that the person convicted was engaged in hunting or fishing at the time of the offense. The court shall immediately notify the commissioner of fish and game of the conviction.

§ 2201a. Sanitary landfills, towns to maintain

a) Each town and city shall provide for the operation and maintenance of sanitary landfills, incinerators or both as the exclusive means for disposal of garbage and refuse, subject to the regulations established by the board of health.

b) Where immediate compliance with this section will work an extreme hardship on a municipality, the department of health may waive such compliance for a period not to exceed two years from the date of the initial waiver.

c) The department of health shall grant an exception to permit the use of open dumps which are not within the view of a public highway, except a dump access road, when sanitary landfills and incinerators are impractical because of cost, terrain, or other factors. The department shall review the exceptions granted at least every two years. If plantings of trees or shrubs are used to effect eventual compliance with this paragraph, the department of health may grant additional waivers to permit the growth of such plantings.

d) A municipality may fulfill the requirements of this section through the use of an incinerator or a sanitary landfill of a neighboring municipality which is in compliance with this section by agreement made between the respective municipalities. A municipality may also fulfill the requirements of this section by contracting for the use of a private incinerator or private landfill or both within such municipality or in another municipality provided that such facility is in compliance with this section and the regulations established by the board of health.

e) A municipality which violates this act shall forfeit $100.00 to the State of Vermont for each violation. Failure to comply in any month shall constitute a separate violation. Added 1967, No. 90 § 2, eff. July 1, 1969; amended 1969, No. 2, § 1; amended 1969, No. 287 § 2 (Adj. Session) eff. Sept. 1, 1970.

§ 2202. Garbage disposal; regulation by town

Subject to section 2201a of this title, a town or city may make, amend or repeal regulations for disposal of garbage, refuse, waste and rubbish within its limits and to impose penalties for the breach thereof, not to exceed a fine of $100.00 for each violation. This section shall not be construed to permit the existence of a nuisance. Amended 1967, No. 90 § 3, eff. July 1, 1969.

§ 2203. Out-of-state collection

a) No person may dispose of or cause to be disposed of within the state any commercial or residential refuse, garbage or waste material collected or transported from outside of the state.

b) A person who violates this section shall be fined not more than $100.00 for each offense.

c) Nothing herein shall prohibit the disposal within this state of any commercial or residential refuse, garbage, or waste material collected or transported from outside the state by a person or by his agents or employees in performance of any written agreement executed prior to passage of this act. This subsection (c) shall expire January 1, 1972. Added 1969, No. 36 § 1, eff. April 1, 1969.

§ 2204. Exceptions

Section 2203 of this title shall not apply to:

1) agreements entered into by a municipality or planning commission on or before the effective date of this act for the disposal or

collection of refuse, garbage or waste material; or

2) municipalities permitting the disposal of refuse, garbage or waste material from a contiguous municipality in another state provided that the other state has reciprocal provisions. 1969, No. 36, § 2, eff. April 1, 1969.

WATER POLLUTION CONTROL

TITLE 10

Chapter 33

Subchapter 2. Mill Refuse

§ 951. Deposit of Sawmill Waste in Waters

(a) It shall be unlawful for a person to deposit edgings, slabs, sawdust, shavings or any other sawmill refuse in the waters of any stream, pond, reservoir, or lake in this state or on the shores or banks thereof in such a manner as to be subject to being washed in the main stream or body of water under normal high water conditions.

(b) A person who violates the provisions of subsection (a) shall be fined no more than $100.00 for each offense. Amended 1963, No. 224, 1967 No. 112.

DISPOSAL OF SEWAGE SLUDGE, EFFLUENT OR WASTE

Regulation adopted by State Board of Health
April 19, 1982

Sewage, sewage sludge, sewage effluent or any waste material removed or pumped from a septic tank, cesspool, seepage pit, privy pit or any other portion of a sewage disposal system or sewage treatment system must not be dumped, discharged or deposited in a location or in a manner that will constitute or create a public health hazard. Such sewage, sludge, effluent or waste material must either be buried under the surface of the ground in a location that will not adversely affect water supply sources, streams, rivers, ponds or lakes or it may be discharged into a sewage treatment plant where it will be properly and adequately processed. The digested sludge from a properly and adequately operating sewage treatment plant may be deposited on the ground surface for agricultural fertilization in an area where it is not likely to be directly contacted by humans.

VERMONT HEALTH REGULATIONS CHAPTER 11

STATE DEPARTMENT OF HEALTH

5-1101 DEFINITIONS

Sanitary landfill—a method of disposing of refuse on land without creating nuisances or hazards to public health, safety, air or water pollution by utilizing the principles of engineering to confine the refuse to the smallest practical area, to reduce it to the smallest practical volume and to cover it with a layer of earth or other approved material at the conclusion of each day's operation.

Incinerator—a furnace designed for the volume reduction of refuse by burning in a firebox with proper controls to maintain a proper temperature range with stack emissions which do not exceed air pollution control limits.

Refuse—all putrescible and non-putrescible solid wastes including garbage, rubbish, ashes, digested sludge and solid commercial and industrial wastes but excluding human and animal intestinal wastes. Ashes or incinerator residue containing unburned material shall be considered refuse.

Refuse disposal area—land used for ultimate disposal of refuse and garbage by any means.

Garbage—putrescible animal and vegetable wastes resulting from handling, processing and preparing foods for consumption or sale for consumption.

Open Dump—a refuse disposal area where solid wastes are deposited without compaction and/or without compacted cover at the end of a day's use.

5-1102 DESIGN

Any municipal or other corporation, person, partnership or firm intending to establish, construct or operate a refuse disposal area shall submit suitable plans of the same including a topographic map at a scale of not more than 200 feet to the inch with five foot contour intervals. These plans will be subject to the review of the Protection Division of the Agency of Environmental Conservation and the technical approval for the refuse disposal area to operate will be issued by the director of that division. The map shall show the proposed fill area, any borrow area access roads, grades for proper drainage of each lift required and a typical cross-section of a lift, special drainage, if necessary, fencing surrounding area usage, adjacent water supplies, shelters for equipment and personnel and any other information pertinent to the satisfactory operation of the area.

All plans and map shall be accomplished by registered professional persons as required by statute for structures, projects or developments involving the public health and safety.

The geological characteristics of the proposed site shall be determined by on-site testing or from earlier reliable survey data.

The soil used as cover material shall be of such character that it can be compacted to provide a tight seal, does not crack excessively when dry, and is relatively free of putrescible materials and large objects.

Sanitary landfill operations shall be designed so that water pollution is not likely to occur. The deposited material must be kept sufficiently low in moisture content to forestall the production of leachate.

Adequate numbers, types and sizes of equipment shall be specified for operating the landfill in accordance with good engineering practice and with these standards.

5-1103 PREPARATION OF THE SITE

Access roads shall be designed and constructed so that traffic will flow smoothly and will not be interrupted by ordinary inclement weather. Access to the site by unauthorized persons shall be limited by suitable fencing.

Suitable shelter for landfill equipment shall be provided when such equipment usually remains on site.

Suitable shelter and sanitary facilities shall be provided for personnel.

Suitable measures shall be taken to prevent fires and water pollution.

5-1104 OPERATIONS

Access to a sanitary landfill shall be limited to those times when an attendant is on duty and only to those authorized to use the site for disposal of refuse.

Blowing paper shall be controlled by providing a portable fence near the working area. The entire area shall be policed regularly.

Unloading of refuse shall be continuously supervised.

Refuse shall be spread in shallow layers not exceeding a depth of two feet of uncompacted material and compacted to a depth of 4" before more refuse is added and spread.

Individual lifts in sanitary landfills shall be no greater than 8 feet in depth of compacted refuse and soil.

A compacted layer of at least 6 inches of suitable cover material shall be placed on all exposed refuse by the end of each working day.

In all but the final lift of a landfill, a layer of suitable cover material compacted to a minimum accumulated depth of one foot shall be placed on all top surfaces of each lift.

A layer of suitable cover material compacted to a minimum accumulated depth of 2 feet shall be placed over the entire surface of each portion of the final lift not later than one week following the placement of refuse with that portion.

Provisions shall be made for the routine operational maintenance of equipment and for the prompt repair or replacement of landfill equipment.

Sewage solids or liquids, septic tank or cesspool pumpings and sewage sludge and grit and other hazardous materials shall be disposed of in a sanitary landfill only if special provisions are made for such disposal with prior approval of the Protection Division of the Agency of Environmental Conservation.

Animal intestinal waste from slaughter houses with possible floor sweepings mixed in must be buried within 2 hours of delivery at the disposal site. The disposal area for such material must be in an area separate from the general area and approved by the Protection Division of the Agency of Environmental Conservation. This area must be fenced sufficiently to keep out animals. Twelve inches of compacted cover soil must be applied at the end of each day of disposal.

No garbage or refuse containing garbage shall be burned. All other burning shall be severely restricted. Air Pollution Regulations promulgated as the result of 10 V.S.A. 15 shall be complied with.

Special provisions may be made for the disposal of large, heavy or bulky items, stumps, trees, leaves, building debris and rubble outside the landfill area.

Salvage of bulky metal, white goods and automobiles is permitted at approved sites if conducted so that air and water pollution does not occur.

Salvage of cans, bottles, paper, rags and plastics is permitted if clean of contaminates and putrescible waste.

If salvaging is permitted, it shall be so organized that it will not interfere with prompt sanitary disposal of refuse or create unsightliness or health hazards. Scavenging shall not be permitted.

Conditions unfavorable for the production of insects and rodents shall be maintained by carrying out routine landfill operations promptly in a systematic manner. Supplemental vector control measures shall be instituted whenever necessary.

Suitable control measures shall be taken wherever dust is a problem. The entire site, including the fill surface, shall be graded and provided with drainage facilities to minimize runoff onto and into the fill, to prevent erosion or washing of the fill, to drain off rain water falling on the fill, and to prevent the collection of standing water.

Chemicals harmful to man and his environment and their containers must not be placed in a sanitary landfill without prior approval of the Protection Division of the Agency of Environmental Conservation.

An inspection of the entire site shall be made by a representative of the Protection Division of the Agency of Environmental Conservation or local department of health before the earthmoving equipment is removed from the site. Any necessary corrective work shall be performed before the landfill project is accepted as completed. Arrangements shall be made for the repair of all cracked, eroded and uneven areas in the final cover during the year following completion of the fill.

A landfill operation shall be under the direction of a responsible individual.

Domestic animals shall be excluded from the site.

5-1105 INSPECTION AND EVALUATION

Routine inspections and evaluations of landfill operations shall be made by a representative of the State Protection Division of the Agency of Environmental Conservation. The local and state departments of health may inspect landfill operations at any reasonable time to insure the control of health hazards. A notice of any deficiencies, together with any recommendations for their correction, shall be provided to the owner or agent responsible for the use of the land; and the appropriate individual, firm or governmental agency responsible for the landfill operation.

Repetitive deficiencies not being corrected may require the approval to be withdrawn.

APPENDIX VI
STATE SOLID WASTE MANAGEMENT RESOURCE RECOVERY ACT

STATE SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY ACT

Subject:
State Solid Waste Management and Resource Recovery

Purpose:
It is the purpose of this bill to authorize a plan for a state-wide system or systems for the management, collection, transportation, storage and disposition of solid waste in an efficient, healthy and economic manner and to promote wherever possible the recycling or recovery of solid waste products.

Sec. 1. DEFINITIONS

For the purpose of this Act, the following words and phrases shall have the following meaning:

(a) "Commission" means the Vermont Solid Waste Management and Resource Recovery Commission.

(b) "Operator" means a person who stores, collects, transports, separates, processes or disposes of solid waste originating from more than two (2) primary sources whether or not for profit.

(c) "Person" means any individual, partnership, co-partnership, firm, company, corporation, association, joint stock company, trust, estate, county, municipality, or any other legal representative, agent or assigns.

(d) "Secretary" means the secretary of the agency of environmental conservation.

(e) "Solid Waste" means useless, unwanted, or discarded material with insufficient liquid content to be free flowing.

(f) "Solid Waste Management" means the storage, collection, transport, separation, processing, recovery and disposal of solid waste.

(g) "State Plan" means the state solid waste management and resource recovery plan adopted by the secretary of the agency of environmental conservation under this subchapter.

Sec. 2. VERMONT SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY PLAN

The secretary shall publish and adopt, after notice and public hearing pursuant to chapter 25 of Title 3, a state solid waste management and resource recovery plan for the state and rules to implement the provisions of this subchapter and the state plan for management, including separation of solid waste materials into designated components by any person as may be necessary, collection, transportation, storage and disposition of solid waste by any means and including any facilities related thereto in an efficient healthy and economic manner and to promote wherever possible recycling or recovery of solid waste products. Pursuant to such plan the secretary may establish solid waste management districts and solid waste operator franchises subject to sections 6 and 7 within such districts as may be required for orderly implementation of the state plan. In establishing facilities or locations the plan and order shall provide for screening, landscaping and other means to avoid or reduce adverse aesthetic impact of such facilities or locations in the area.

Sec. 3. POWERS OF THE SECRETARY

The secretary shall have the power to:

(a) contract in the name of the state for the service of independent contractors under bond or with an agency or department of the state or a town to perform services or to provide facilities necessary for the implementation of the state plan including but not limited to the collection, transportation and disposition of solid waste.

(b) purchase, lease or rent land or facilities or use, land owned by the state or any agency or department thereof as may be necessary for implementation of the state plan.

Sec. 4. VERMONT SOLID WASTE MANAGEMENT AND RESOURCE RECOVERY COMMISSION

A Vermont solid waste management and resource recovery commission is established and shall consist of a chairman and two members, to be appointed by the Governor, with the advice and consent of the senate, for terms of four years, excepting that one of the initial appointments shall be for a term of two years, and another of the initial appointments shall be for a term of three years. Terms of members shall expire on January 31st of the year of expiration.

Sec. 5. COMMISSION; DUTIES AND COMPENSATION

(a) The commission shall hear and determine all matters and applications involving the award, revocation or modification of franchises for solid waste management operators subject to the provisions of sections 6 and 7 and appeals pursuant to section 8 of this subchapter from an act or decision of the secretary. Compensation of members shall be $25.00 per diem plus reasonable and necessary expenses.

Sec. 6. PERMITS AND DISTRICT FRANCHISES

(a) No operator shall collect, store, transport, process, recover resources from, or dispose of solid waste without first obtaining an operator's permit from the secretary. Such permit may be issued with conditions to assure that the operator will conform with such standards or requirements as may be promulgated governing solid waste management. Any permit shall be renewed annually provided that the operator and his solid waste management activities have been in compliance with the requirements of this chapter and regulations promulgated hereunder. In addition, any permit shall conform and be consistent with the state plan and no rights to renewal of a permit shall accrue to any operator unless such renewal be in conformity with the requirements of the state plan.

(b) Where the state plan requires that the number of operators within a district or districts be restricted, the commission shall award in lieu of an operator's permit a franchise or franchises to qualified operators upon public notice and after public hearing subject to the provisions of section 7 of this subchapter. Any person applying for a franchise shall submit such information as may be required by the commission to assure that such person can comply with the standards and requirements of the commission and the state plan and rules promulgated under this subchapter. No franchise shall be for a period exceeding two years.

Sec. 7. RATES AND FRANCHISES—PUBLIC SERVICE BOARD

(a) A person awarded a franchise shall be subject to the jurisdiction of the public service board for the purpose of setting rates, tolls, charges or schedules, under 30 V.S.A. §209 (4) and §218 and the commission shall not award a franchise to any person until the approval of any proposed rates, tolls, charges or schedules has been granted by the public service board. For the purpose of this section, the commission and the public service board may hold joint hearings and shall cooperate in any manner which will promote efficient and expeditious implementation of the state plan.

(b) After public notice and hearing and upon certification by the secretary that the state plan has been substantially implemented within a designated solid waste management district any franchise within such district shall be subject to the exclusive jurisdiction of the public service board pursuant to chapter 5 of title 30 as a public utility; in exercising its jurisdiction, the public service board shall adhere to any relevant plan, rule or requirement duly promulgated by the secretary until such time as the board supercedes such plan, rule or requirement after public notice and hearing pursuant to its general authority under chapter 5 of title 30.

Sec. 8 APPEALS TO COMMISSION

Any person or party in interest aggrieved by an act or decision of the secretary pursuant to this subchapter may appeal such act or decision to the commission within thirty days from the date thereof. The commission shall hold a hearing at which all persons and parties in interest may appear and be heard and shall issue an order affirming, reversing or modifying the act or decision of the secretary within 10 days following the conclusion of the hearing. Such order shall be binding upon the secretary. An appeal filed pursuant to this section shall not stay the effectiveness of any act or decision of the secretary pending determination by the board. Appeals from final decision of the commission shall be in accordance with chapter 25 of title 3.

Sec. 9. ENFORCEMENT

For the purpose of this subchapter the secretary may, in addition to any other enforcement powers that may be provided for by law, exercise those enforcement powers specified in 3 V.S.A. §2822(c).

Sec. 10 CRIMINAL PENALTIES

Every person convicted of violating this chapter or the rules and regulations authorized herein or the terms or conditions of any permit or franchise granted by the commission, shall be subject to a fine not to exceed $5,000 or imprisonment for not more than six months in a county jail, or both.

(a) Each day of continued violation of the provisions of this chapter or rules and regulations authorized herein shall be deemed a separate offense.

Sec. 11. SOLID WASTE MANAGEMENT ASSESSMENT

(a) Imposed—Amount—Collection.

(To be added)

(b) Allocation of the funds collected pursuant to this section, shall be utilized by the secretary to implement the state plan including reimbursement to the public service board for costs or expenses incurred by it in discharge of the duties imposed upon it under section 7 of this subchapter.

(c) Any funds collected pursuant to this section not utilized by the secretary during that fiscal year be held escrow for use during the next fiscal years subject to approval of the legislature.

Sec. 12. TOWNS AND CITIES

(a) A town or city may make, amend or repeal regulations pertaining to solid waste management within its limits and impose penalties for the breach thereof, not to exceed a fine of $100.00 for each violation provided that such regulations are consistent with the state plan and rules of the secretary promulgated pursuant to this subchapter. This section shall not be construed to permit the existence of a nuisance.

(b) A municipality may fulfill the requirements as may be imposed by the state plan and rules of the secretary subject to approval by the secretary through agreement between any other unit of government or operator having a permit from the secretary or franchise from the commission or public service board as the case may be.

Sec. 13. 24 V.S.A. §2241(8) is amended to read:

(8) "Junkyard" means any place of outdoor storage or deposit, whether in connection with a business or not, which is maintained, operated or used for storing, keeping, processing, buying or selling junk, or for the operation of an automobile graveyard. However, the term does not include *any facility subject* [a private garbage dump or a sanitary landfill] *to subchapter 8* [which is in compliance with 24 V.S.A. §2201a] and the regulations of the secretary of [human services] environmental conservation. It does not mean a garage where wrecked or disabled motor vehicles are temporarily stored for a reasonable period of time for inspection, repairs, or subsequent removal to a junkyard.

Sec. 14 24 V.S.A. §2245 is amended to read:

§2245. INCINERATORS, SANITARY LANDFILLS, ETC., EXCEPTED

The provisions of this subchapter shall not be construed to apply to *any facility subject to subchapter 8* [incinerators, sanitary landfills or open dumps wholly owned OR leased and operated by a municipality for the benefit of its citizens, or to any private garbage dump or any sanitary landfill, which is in compliance with 24 V.S.A. §2201a] and the regulations of the secretary of [human service] environmental conservation.

Sec. 15 10 V.S.A. §2201(a) is repealed.

Sec. 16. 10 V.S.A. §2205 is repealed.

Sec. 17 APPROPRIATION

The sum of $175,000 is hereby appropriated to be used by the agency of environmental conservation for the implementation of the provisions of this subchapter, said sum to be repaid to the general fund from receipts under section 11 hereof.

Sec. 18 EFFECTIVE DATE

The effective date of this act is July 1, 1973.